June 2003

Economic Analysis of Management Alternatives for Personal Watercraft in Amistad National Recreation Area

Revised Final Report

Prepared for

Dr. Bruce Peacock
National Park Service
Environmental Quality Division

Prepared by

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1 Introduction

Historically, NPS classified PWC with other water vessels, which allowed their use when the use of other vessels was permitted. More recently, NPS has reevaluated its methods of PWC regulation. This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in Amistad National Recreation Area (AMIS).

Historically, the National Park Service (NPS) classified personal watercraft (PWC) with all other water vessels, which allowed people to use PWC when the use of other vessels was permitted by a Superintendent's Compendium.[1] In recognition of its duties under the Organic Act and NPS Management Policies, as well as increased awareness and public controversy, NPS reevaluated its methods of PWC regulation. Because of new information regarding potential resource impacts, conflicts with other users, and safety concerns associated with PWC use, NPS proposed a PWC-specific regulation in 1998. The regulation stipulated that PWC would be prohibited in units of the national park system unless NPS determines that PWC use is appropriate for a specific unit based on that unit's enabling legislation, resources and values, other visitor uses, and overall management objectives (63 FR 49,312–17, September 15, 1998). This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in Amistad National Recreation Area (AMIS), along the United States border near Del Rio, Texas.

During a 60-day comment period, NPS received nearly 20,000 comments on this proposed regulation. As a result of public comments and further review, NPS promulgated an amended regulation in March 2000 allowing NPS to permit PWC use in 11 units by promulgating a special regulation and in an additional 10 units by amending the Superintendent's Compendiums (36 CFR 3.24[b], 2000). The March 2000 regulation provided park units a 2-year grace period in which PWC use could continue after which

[1] A compendium is an NPS management tool used specifically by a park superintendent to take actions to address park-specific resource protection concerns.

time PWC would be banned from any park that took no action to promulgate either PWC-specific regulations or to regulate PWC use in the Superintendent's Compendium.

On August 31, 2000, Bluewater Network et al. filed a complaint with the United States District Court for the District of Columbia against NPS alleging, among other things, that the NPS rule-making decisions to allow PWC use in some park units after 2002 by making entries in Superintendent's Compendiums would not provide the opportunity for public input. In addition, the environmental group claimed that because PWC cause water and air pollution, generate noise, and pose public safety threats, NPS acted arbitrarily and capriciously when making its September 1998 and March 2000 decisions.

A settlement agreement between NPS and Bluewater Network was signed by the District Court on April 12, 2001. The agreement requires all park units wishing to continue PWC use to promulgate special regulations only after each unit conducts an environmental analysis in accordance with the 1969 National Environmental Policy Act (NEPA). At minimum, the NEPA analysis must evaluate the impacts of PWC on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety. In addition, NPS is required by federal statutes, including Executive Order 12866, to conduct a benefit-cost analysis of the proposed regulation and analyze the impact of the regulation on small businesses under the Regulatory Flexibility Act (RFA) of 1980. Based on this settlement, PWC use in AMIS was to be prohibited as of September 16, 2002. However, a stipulated modification to this settlement agreement was approved by the court on September 9, 2002 that permitted PWC use in AMIS until November 6, 2002. After that date, PWC use in AMIS was prohibited until the final rule is published.[2] This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in AMIS, as required by the terms of the April 2001 settlement and by applicable federal statues.

[2] Under the no-action alternative, PWC use would continue to be banned.

1.1 ORGANIZATION OF REPORT

This report presents NPS's economic analysis of the alternative AMIS PWC regulations under consideration. The report is organized as follows. Section 1 describes the reason for the regulation and the current and proposed regulations at AMIS. Baseline visitation, environmental conditions, and economic activity in AMIS are described in Section 2. The local economic impacts on the region surrounding AMIS are summarized in Section 3. Section 4 describes the methodology for assessing the impacts of the alternatives on social welfare and presents a cost-benefit analysis of the regulatory alternatives. Uncertainties inherent in the analysis are discussed in each subsection. Section 5 provides an analysis of the regulatory alternatives' impacts on small businesses and an initial regulatory flexibility analysis (IRFA). In addition, Appendix A describes the principles of economic impact analysis, and Appendix B includes a detailed theoretical discussion of the types of benefits and costs associated with PWC restrictions in national parks and the methods used in their estimation.

1.2 PROBLEM ADDRESSED BY REGULATION

In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation.

The U.S. Office of Management and Budget (OMB) directs regulatory agencies to demonstrate the need for their rules (OMB, 1992). In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation. If each producer and consumer has complete information on his or her actions and makes decisions based on the full costs of those actions, resources will be allocated in a socially efficient manner. However, when the market's allocation of resources diverges from socially optimal values, a market failure exists. A defining feature of a market failure is the inequality between the social consequences of an action and a purely individual perception of benefits and costs. The major causes of market failure identified in the OMB guidance on Executive Order 12866 are externalities, natural monopolies, market power, and inadequate or asymmetric information. For environmental problems resulting from market failures, this divergence between private and social perspectives is normally referred to as an externality. Such divergences occur when the

actions of one economic entity impose costs on parties that are external to, or not accounted for in, a market transaction or activity.

The justification for restricting PWC use in national parks is based on externalities associated with their use.

The justification for restricting PWC use in national parks is based on externalities associated with their use. For instance, the operation of PWC imposes costs on society associated with noise emissions, air and water pollution emissions, and health and safety risks. Because PWC users have little incentive to consider these external costs, they are likely to make decisions about PWC use without considering these impacts on other people.

If these externalities are internalized to the PWC users generating them, the problem can be mitigated. For example, if PWC users were required to pay for the marginal external costs they impose on others, they would begin to take those costs into account when making decisions and the market failure would be corrected. However, accurately assigning costs associated with each individual PWC user's actions and enforcing payment is essentially not feasible at this time. Other regulatory options to address the externalities associated with PWC use are far easier to implement and enforce. Some of these options include restricting areas where they are permitted, the time of day when they can be used, and PWC engine type.

The extent to which social welfare improves because of PWC regulation depends on the relative costs and benefits associated with such restrictions. Although non-PWC users gain from PWC restrictions, the PWC users and local businesses that serve them experience welfare losses.

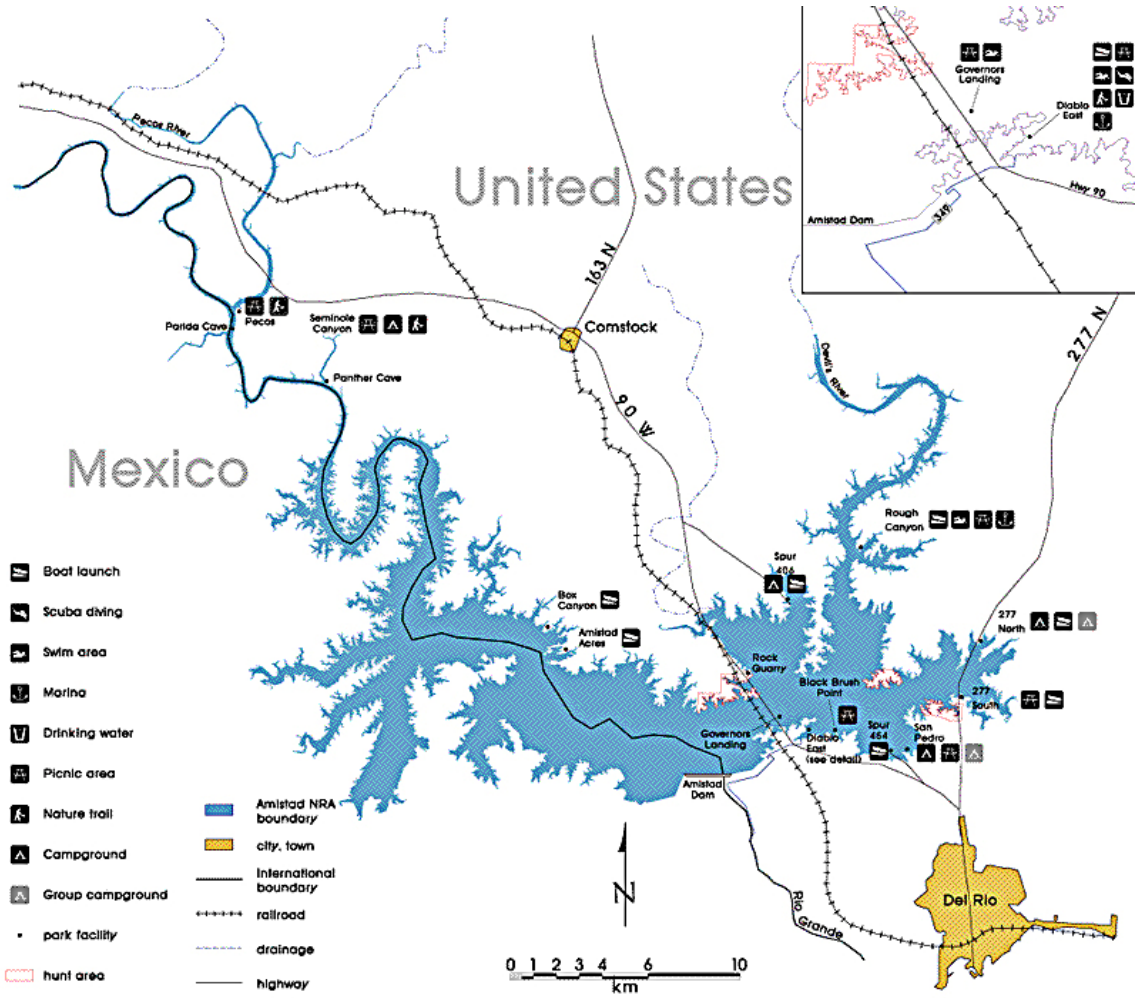
The extent to which social welfare improves because of PWC regulation depends on the relative costs and benefits associated with such restrictions. Although non-PWC users gain from PWC restrictions, the PWC users and local businesses that serve them experience welfare losses. Thus, the likelihood that a particular regulatory option will improve social welfare in an individual national park unit depends on numerous park-specific factors that influence the level of costs and benefits. Although a given set of restrictions on PWC use in one park may improve social welfare, the same set of restrictions in another park could easily have negative impacts on social welfare. For example, banning PWC in a park where there is little other motorized boating activity may result in large proportionate reductions in noise and emissions, whereas banning PWC in a park with a high level of other motorized boating activity may not have a noticeable effect on noise or emissions levels. In the latter case, the costs to PWC users could be larger than the gains to other park visitors. Thus, it is important to

consider the conditions specific to each individual park in selecting the preferred regulatory alternative for that park.

1.3 CURRENT PWC ACTIVITIES IN AMIS

PWC use in AMIS (including operating, transiting, launching, and beaching) is currently prohibited in all park waters as a result of the settlement agreement on September 9, 2002. In accordance with the September 9, 2002, stipulated modification to the April 2001 settlement agreement, PWC use in AMIS is prohibited unless a final rule authorizing its use is promulgated. Figure 1-1 is a map of AMIS that identifies the national park boundary.

Figure 1-1. Map of AMIS



1.4 PROPOSED REGULATIONS

The following three alternatives are being considered for managing PWC in AMIS.

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation

Through November 6, 2002, PWC use was authorized in AMIS in accordance with the Superintendent's Compendium. Under Alternative A, a special regulation would reinstate PWC use in AMIS wherever motorized vessels are authorized, which includes PWC. The Superintendent's Compendium closes Hidden Cave Cove, Painted Canyon, and the water extending 300 feet from Amistad Dam to all public use and prohibits all visitors, including PWC users, from landing in areas with interior least tern nesting colonies. Terns nest on islands and peninsulas on the lake from May 1 through August 31. To avoid disturbing nesting activities, these areas are closed to all public use during the nesting season. In addition, PWC users at AMIS must comply with State of Texas regulations, identified in Table 1-1 below.

Proposed Regulations for PWC Use in AMIS

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation

Alternative B: Reinstate PWC Use, Under a Special Regulation, With Management Restrictions

Alternative C: No-Action Alternative (Continue PWC Ban)

Alternative B: Reinstate PWC Use, Under a Special Regulation, With Management Restrictions

Under Alternative B, a special regulation would reinstate PWC use, as in Alternative A but with the following restrictions:

- The Pecos River would be closed entirely to PWC use.
- PWC would be prohibited on the Rio Grande north of buoy 28.
- PWC would be prohibited on the Devils River north of buoy P, approximately 4 to 5 miles south of Indian Springs.
- PWC would be prohibited east of the San Pedro SPC-1 buoy, which would close all of San Pedro Canyon to PWC use.
- Two boat ramps in San Pedro Canyon would be closed to PWC use (the 277 north and south ramps).
- The Pecos River boat ramp would be closed to PWC.

Table 1-1. Texas Parks and Wildlife Code Applicable to PWC

Category	Regulation
Time of operation	➤ No PWC operation allowed between sunset and sunrise.
Operating restrictions	➤ No PWC operations within 50 feet of any other vessel, person, stationary platform or other object, or shore, except at headway speed.
	➤ Operator must be 16 years of age, be accompanied by a person at least 18 years of age, or must be at least 13 years of age and have successfully completed a boating safety course prescribed and approved by the state.
	➤ No PWC may be operated in any area where motorboat use is prohibited by state law or local rule or regulation.
	➤ No towing water skis, an aquaplane, a surfboard, a tube, or any similar device, unless the craft is designed to carry a minimum of two persons.
	➤ No jumping the wake of another vessel recklessly or coming unnecessarily close to that vessel.
	➤ No operation in a manner that requires the operator to swerve at the last possible moment to avoid a collision.
Safety	➤ Each occupant must wear a U.S. Coast Guard-approved personal flotation device.
	➤ The cutoff switch (if provided) must be attached to the operator.

Source: National Park Service (NPS). 2003. *Amistad National Recreation Area Personal Watercraft Use Environmental Assessment.* Washington, DC: National Park Service.

Concessioners within the recreation area would comply with the following regulations:

- ➤ No one under the age of 21 could rent PWC.
- ➤ PWC users ages 16 to 20 must operate within eyesight of an adult (21 and older).
- ➤ PWC operators under 16 must have an adult on board.
- ➤ Concessioners must carry liability insurance of $1 million.
- ➤ Concessioners must administer boat safety instruction to all PWC renters who do not have a boater safety certification; all renters would be required to view the video and sign a statement indicating that they will follow the printed safety instructions.

Park staff would improve and enhance enforcement under this alternative to reduce accidents and user conflicts by increasing boat patrols, monitoring areas by land, and increasing the number of rangers working in the park.

Alternative C: No-Action Alternative (Continue PWC Ban)

Under the no-action alternative, no unit-specific rule would be developed to reinstate PWC use in AMIS. Therefore PWC use would be prohibited in AMIS permanently, in accordance with Bluewater Network v. Stanton, No. CV02093 (D.D.C. 2000), the settlement agreement approved by the court on April 12, 2001, and subsequent September 9, 2002, modification.[3]

[3] As noted above, PWC are currently banned from AMIS until the publication of the final rule for management of PWC use in the park. Under the no-action alternative, this temporary ban would become permanent.

2 Description of PWC Use in Amistad National Recreation Area

PWC use in AMIS could potentially have negative impacts on water and air quality, soundscapes, wildlife and wildlife habitats, and cultural and ethnographic resources. However, due to the relatively small number of PWC used in AMIS prior to the ban, reinstating PWC use is estimated to impose only minimal incremental impacts on these resources.

AMIS, consisting of 57,272 acres, is located in southern Texas on the United States-Mexico border (see Figure 1-1). AMIS is a man-made reservoir created as a result of the Treaty of February 3, 1944, which authorized building Amistad Dam. The dam was completed in 1968. The lake was built to take advantage of water storage opportunities at the confluence of the Devils River, the Rio Grande, and the Pecos River near Del Rio, Texas. Amistad Reservoir occupies much of the southern boundary of Val Verde County, Texas and many miles of the shoreline of the Rio Grande, Devils, and Pecos Rivers.

AMIS was designated as a national recreation area on November 28, 1990 to "provide for public outdoor recreation use and enjoyment of the lands and waters associated with the United States portion…of Lake Amistad Reservoir," and to protect "scenic, scientific, and cultural…value(s)" (Public Law 101-682, November 28, 1990). To this end, AMIS is managed to enhance recreational opportunities. Public facilities including boat ramps, docks, campgrounds, and picnic areas have been developed and are maintained at various locations around the lake. The lake has also become a popular destination for bass fishing tournaments.

2.1 PWC USE, AREA ACCESS, MAINTENANCE, AND ENFORCEMENT AT AMIS

Although PWC use is currently banned in AMIS (see Section 1.3), this section reviews PWC access, maintenance, and enforcement prior to the ban. The earliest documented record of PWC at AMIS was in March 1989, when a citation was issued to a PWC operator for reckless and negligent operation inside a swim beach at Viewpoint Cliffs (NPS, 2003). NPS staff observations indicate that PWC use at AMIS increased through the 1990s. The typical PWC use season lasted from May to October, but PWC were occasionally observed on Lake Amistad in March and April. AMIS did not provide any facilities solely for PWC users. Facility maintenance and law enforcement activities that were associated with PWC use at AMIS were incidental to other park services. Motor vessel access to Lake Amistad is provided by two marinas and twelve paved launch ramps (see map in Section 1). Some of the ramps are not available at low water levels. There are marinas with launch facilities at Lake Amistad and Southwinds. Launch ramps are located at Rough Canyon, 277 North, 277 South, Spur 454, Black Brush Point, Diablo East, U.S. Air Force (two ramps), Spur 406, Amistad Acres, Box Canyon, and Pecos River.

State PWC regulations that address age requirements, education requirements, timing restrictions, and types of operations were enforced at AMIS by NPS and other agencies. U.S. Park Rangers employed by NPS enforced PWC regulations in conjunction with Texas Parks and Wildlife game wardens. Also, U.S. Border Patrol staff had responded in the past to emergency incidents. Between 1991 and 2001, 143 written violation notices were issued to watercraft operators, including PWC operators, on Lake Amistad. Of these notices, 26 were issued to PWC users and 117 to other boat operators. Table 2-1 provides a breakdown of PWC and boating citations issued. Between 1991 and 2001, there were 176 recorded watercraft accidents, 160 involving boats and 16 involving PWC. PWC accidents comprised 18 percent of all watercraft citations and 9 percent of all watercraft accidents.

Although PWC are more maneuverable and can access more areas than other types of motorized watercraft, they generally operate within more localized areas partly because of the nature of PWC, which are primarily intended to be short-distance, recreational

Table 2-1. AMIS Watercraft Accidents and Citations, 1991-2001

Year	All Water-Craft Accidents	PWC Accidents	All Water-Craft Citations	PWC Citations
1991	27	0	21	7
1992	25	0	13	1
1993	28	2	29	4
1994	23	5	22	5
1995	13	1	19	3
1996	12	1	3	1
1997	6	1	14	3
1998	13	3	8	0
1999	13	1	4	1
2000	6	2	5	1
2001	10	0	5	0
2002	10	1	12	0
Total	176	16	143	26

Source: National Park Service (NPS). 2002a. "PWC Statistics for Amistad National Recreation Area." Collected by Greg Garetz, National Park Service, 2001-2002.

vehicles that can accelerate and decelerate quickly. Therefore, PWC users at AMIS commonly used somewhat open waters where they could travel at high rates of speed and perform stunts. Because of their maneuverability, PWC were also reported exploring narrower waterways.

NPS staff previously observed PWC traveling throughout the lake, either singly, in pairs, in small groups, or in association with a motorboat. Some PWC were associated with 56- to 65-foot houseboats from the marina at Lake Amistad. The people who rent houseboats can go anywhere on the lake and could previously take their PWC with them. Often, two or three PWC were observed traveling in association with the rental houseboats. Some houseboat renters who do not own PWC rented them from the marina at Lake Amistad.

Historically, NPS staff observed PWC use at AMIS in five specific areas:

- Spur 454—This area contains the closest boat launching location to the Del Rio city limits and also is one of the few

areas on the lake where observers could view PWC from the road. The San Pedro Arm of the lake at the end of Spur 454 was the only area where PWC operators tended to consistently congregate, regardless of lake level. Many local PWC owners used this area and regularly came out in groups, including large, extended families, and having four to six PWC in their group.

- Diablo East—This is the largest boat ramp and parking area on Lake Amistad and is the primary access point for bass fisherman during low lake levels. According to NPS staff, approximately 50 percent of PWC users in this area were out-of-town visitors who were using PWC in association with houseboat rentals from the marina at Lake Amistad. Other PWC users included visitors from San Antonio (about 3 hours away), New Mexico or other nearby states, and from Mexico. Many PWC users in this area were overnight weekend visitors.
- Rough Canyon—This boat ramp and parking lot are located on the Devils River arm of the lake, and the ramp is one of two ramps open during extremely low water levels. This is the ramp closest to the popular Indian Springs destination in the upper Devils River section of the lake. While in route to the Indian Springs destination, PWC tended to either travel in a direct line or explore coves between the destination and the launch point.
- Southwinds Marina—This boat ramp and parking area was built by Laughlin Air Force Base for their base personnel but is also available for the general public. Most PWC operators who launched here were active military personnel from the base. NPS staff did not observe a specific destination area for PWC launching from this ramp but observed PWC traveling to Spur 454, up the Devils River Arm towards Rough Canyon and Indian Springs, towards Castle Canyon, and to the Rio Grande Arm.
- Box Canyon—This is the only launch point on the upper section of the lake. PWC operators here were primarily those that live in the Box Canyon or Amistad Acres residential area or the residents' friends. NPS staff observed PWC from this area operating on the Rio Grande Arm of the lake near channel buoy 12 and in adjacent coves.

2.2 VISITATION DATA

Sections 3 and 4 present analyses of the economic impacts and the social benefits and costs of PWC use under alternative regulations in AMIS from 2003 through 2012. To support the development of these estimates, Section 2.2 presents projections of baseline PWC and non-PWC visitation for this period and discusses the methodology used to calculate the projections. The projected baseline represents visitation

to AMIS after imposition of the ban on PWC use, as discussed in Section 1.3. In addition, projected visitation expected to have occurred in the absence of the ban is presented.

2.2.1 Historical AMIS Visitation Data

Table 2-2 presents the 2001 monthly visitation estimates for AMIS. According to NPS reports, the estimated total number of recreational visitors to the AMIS area in 2001 was 1,097,650. Between the months of May and October, which corresponds to the typical PWC season, AMIS received 586,094 visitors (53 percent of annual visitation). The estimated total number of recreational visitors was based on road traffic counts at park entrances and multiplication of these counts by 3.5 to account for the estimated average number of people per vehicle.

Table 2-2. Monthly Recreational Visitation to AMIS, 2001

Month	Recreational Visits
January	76,104
February	63,318
March	130,965
April	108,854
May	106,364
June	131,672
July	114,774
August	82,970
September	79,889
October	70,425
November	79,087
December	53228
Total	1,097,650

Source: National Park Service (NPS). 2002b. "Visitation Records." <http://www.nps.gov>. As obtained in April 2002.

As shown in Table 2-3, visitation to AMIS has fluctuated over the past 2 decades, but the number of visitors in 2001 was the third-lowest total since 1979. Park visitation tends to parallel lake levels.

Table 2-3. Annual Recreational Visitation to AMIS, 1979-2001

Year	Total Visitation	Year	Total Visitation
1979	1,261,846	1991	1,215,691
1980	1,084,689	1992	1,559,659
1981	976,414	1993	1,505,084
1982	1,259,668	1994	1,591,903
1983	1,221,445	1995	1,422,321
1984	1,164,338	1996	1,238,990
1985	1,139,366	1997	1,084,433
1986	1,206,669	1998	1,129,811
1987	1,219,967	1999	1,164,166
1988	1,284,606	2000	1,234,506
1989	1,321,168	2001	1,097,650
1990	1,306,474		

Source: National Park Service (NPS). 2002b. "Visitation Records." <http://www.nps.gov>. As obtained in April 2002.

2.2.2 Historical AMIS Watercraft Visitation Data

Data collected during the summer of 2001 show that PWC were a consistent part of the total boating population of the lake, accounting for between 8 and 20 percent of daily summer boating activity.

AMIS supports a wide variety of boating activities throughout the year, including PWC use prior to the ban, powerboating, water-skiing, houseboating, fishing by boat, sightseeing by boat, canoeing, and kayaking. PWC data were collected by NPS staff beginning May 2001.[1] Data collected during the summer of 2001 show that PWC were a consistent part of the total boating population of the lake, accounting for between 8 and 20 percent of daily summer boating activity. On weekdays, this percentage tended to increase, primarily because fewer tournament bass fishermen were on the lake. Summer weekday PWC use sometimes comprised between 19 percent and 40 percent of total boating activity in the evenings, when the local PWC owners tended to come out to the lake. The busiest day for 2001 PWC visitation was the weekday of July 4, 2001, when 33 PWC trailers and 88 non-PWC boat trailers were observed in boat ramp parking lots throughout the area. The busiest weekend day for PWC visitation was on Saturday, June 23, when 26 PWC trailers and 270 non-PWC trailers were observed in boat ramp parking lots throughout the area.

[1]Watercraft visitation data are collected only when AMIS staff are on patrol.

Using data from trailer counts performed at strategic locations and times, it was estimated that 1,703 PWC were used in AMIS in 2001 (NPS, 2002a).[2] Estimates from other parks indicate that the average group size for PWC users is approximately 3.67 people per PWC (MACTEC et al., 2002a,b,c).[3] Based on this group size, NPS estimates that about 6,249 people used PWC in AMIS during 2001, which equals 0.57 percent of total 2001 AMIS visitation. However, park officials noted that there was considerable uncertainty surrounding this estimate of PWC visitation.[4]

Prior to the ban, most PWC users came to AMIS for the day, although some camped and launched their PWC from shore. Visitors to AMIS included those exclusively using PWC, as well as those who also brought fishing boats or houseboats. According to park staff, most visitors to AMIS come from outside the local area but within a day's driving distance. Given the problems associated with transporting and storing PWC, locals probably factored more heavily in PWC use than in overall park visitation. The PWC used in AMIS were typically two- to three-person machines with conventional two-stroke engines. For those users who rented PWC, very few rentals were available in AMIS (three to six machines, depending on maintenance and repair needs). The marina at Lake Amistad was the only facility in the area that rented PWC. NPS estimates that the proportion of rented PWC used in the park was about 2 percent to 10 percent. As such, most PWC users visiting AMIS likely owned their own PWC.

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[2]Trailer counts were not performed every day. Therefore, for days during the summer season without PWC visitation data, it was assumed that visitation for a weekday was equal to the average 2001 visitation for weekdays and visitation for a weekend day was equal to the average 2001 visitation for weekend days.

[3]This figure is the mean of the corresponding numbers at Big Thicket National Park, Lake Meredith National Recreation Area, and Glen Canyon National Recreation Area.

[4]Because the number of PWC trailers at a particular location are counted only once per day, this count may understate the total number of PWC. If PWC users left prior to the daily count or arrived after the daily count, they would not be included. In addition, PWC trailers are not counted every day.

2.2.3 Projected Visitation

Methodology for Projecting Visitation

To project PWC and non-PWC visitation for the years 2003 through 2012, NPS used the following methodology:

Baseline

1. Calculate average recreational visitation over the five most recent years with data available (1997–2001).
2. Divide the recreational visitation estimated in Step 1 between PWC and non-PWC visitation using estimates of PWC use in 2001 relative to total recreational visits.
3. Project baseline non-PWC visitation for the period 2003–2012 by allowing non-PWC visitation to change from the 1997–2001 average to the population growth rate for the areas from which most visitors to the park originate. The growth rate from 1990–2000 yields an average annual growth rate of 1.39 percent.
4. Assume there would be no PWC use in 2003–2012 under baseline conditions because of the current ban on PWC use in AMIS.
5. Project visitation by former PWC users by assuming a certain fraction will continue to visit AMIS to engage in activities other than PWC use following the ban. These percentages will typically be based on professional judgment, because of the absence of a formal study of PWC use in AMIS.

Without Ban

1. Calculate average recreational visitation over the five most recent years with data available (1997–2001).
2. Divide the recreational visitation estimated in Step 1 between PWC and non-PWC visitation using an estimate of 6,249 PWC users in 2001. This results in an estimate of PWC users accounting for 0.57 percent of visitation.
3. Estimate PWC visitation for 2003–2012 by using the estimates of annual growth in PWC use presented in the Environmental Assessment (EA) of PWC use at AMIS (NPS, 2003). Although the numbers of PWC registered are declining in Texas (TPWD, 2003),[5] park staff estimate that PWC use would increase at a constant rate of 1.5 percent over time in the future. It is assumed here that park staff have the best information available for predicting future PWC use in AMIS.

[5]Statewide, PWC registrations fell by approximately 10 percent per year from 1998 to 2002 (TPWD, 2003).

Projecting Visitation for 2003 through 2012

Following the methodology outlined above, NPS calculated AMIS average annual recreational visitation for 1997–2001 to be 1,142,113. According to NPS estimates, approximately 0.57 percent of 2001 visitors used a PWC in AMIS. Assuming that the percentage of visitors who use PWC remains constant over time, this implies an annual average of 6,502 PWC users and 1,135,611 non-PWC users from 1997 to 2001.

Trends in local population and PWC registrations indicate that PWC use at AMIS will increase by 1.39 percent annually without regulation.

As described above, NPS projects that non-PWC visitation will grow at the rate of population growth for the areas where most visitors to AMIS originate. In the absence of the ban, visitation by PWC users was projected assuming that PWC use will grow at a constant rate over time. NPS believes that most visitors originate from the city of San Antonio and Val Verde County, which surrounds the park on the U.S. side. According to the U.S. Bureau of the Census (2002), population in these two areas experienced an average growth rate of 1.39 percent annually from 1990 to 2000. This rate is well above the national average of 0.9 percent. Table 2-4 presents the projected visitation by current non-PWC users based on applying the annual population growth rate of 1.39 percent to the estimated annual visitation by non-PWC visitors from 1997–2001.

For 2003 to 2012, there is assumed to be no baseline PWC use in the park because PWC were banned in the park as of November 2002. However, many of the former PWC users who can no longer use a PWC in AMIS may continue to visit the park to pursue other types of recreation. It was assumed that 85 percent of PWC users would continue to visit the AMIS park region under the ban (NPS, 2003). This percentage is based on professional judgment and reflects the uniqueness of AMIS compared with nearby recreation areas and the fact that it is not a principal destination for a large number of PWC users. Based on the estimated regional population growth rate, the projected change in PWC ownership, and the assumed percentage of former PWC users who voluntarily stop using PWC in the park that will continue to visit the park for other activities, we present the projected baseline visitation for AMIS from 2003 to 2012 in Table 2-4.

Table 2-4. Projected Baseline Visitation to AMIS, 2003–2012[a]

Year	PWC Users	Non-PWC Users			Total Visitation
		Non-PWC Users in the Absence of the Ban	Visitors that Would Have Used PWC in the Absence of the Ban[b]	Total Non-PWC Users	
2003	0	1,167,395	5,694	1,173,089	1,173,089
2004	0	1,183,619	5,694	1,189,312	1,189,312
2005	0	1,200,068	5,694	1,205,762	1,205,762
2006	0	1,216,746	5,694	1,222,440	1,222,440
2007	0	1,233,656	5,694	1,239,349	1,239,349
2008	0	1,250,800	5,694	1,256,494	1,256,494
2009	0	1,268,183	5,694	1,273,877	1,273,877
2010	0	1,285,808	5,694	1,291,502	1,291,502
2011	0	1,303,677	5,694	1,309,371	1,309,371
2012	0	1,321,795	5,694	1,327,489	1,327,489

[a]These projections are based on the estimated regional population growth rate, the assumed constant level of PWC use, and the assumed percentage of former PWC users who voluntarily stop using PWC in the park who will continue to visit the park for other activities. There is no PWC use in the park after November 6, 2002, under baseline conditions, because PWC were banned on that date.

[b]This category represents visitors who would have used PWC in AMIS in the absence of the ban but would continue to visit the park to engage in alternative activities following the ban. These values were calculated based on an assumption that 85 percent of those people who would have used PWC in the park in the absence of the ban would continue to visit the park to engage in alternative activities.

To estimate the incremental impacts of the alternative management strategies (see Sections 3 and 4), the change in visitation relative to these baseline conditions must be projected. Table 2-5 presents the projected visitation that would have taken place in the absence of the November 2002 ban on PWC use in AMIS.

2.2.4 Sources of Uncertainty in Visitation Projections

NPS estimates of PWC and non-PWC visitation in the years 2003 through 2012 are based on a number of assumptions. In addition, a variety of unpredictable circumstances could affect visitation in a particular year. In general, visitation to AMIS in a specific year will depend on many factors, including

- ➤ economic conditions,
- ➤ weather,
- ➤ natural resource conditions,

Table 2-5. Projected Visitation to AMIS in the Absence of the Ban on PWC Use, 2003–2012

Year	PWC Users	Non-PWC Users	Total Visitation
2003	6,699	1,167,395	1,174,093
2004	6,799	1,183,619	1,190,418
2005	6,901	1,200,068	1,206,969
2006	7,005	1,216,746	1,223,750
2007	7,110	1,233,656	1,240,765
2008	7,216	1,250,800	1,258,017
2009	7,325	1,268,183	1,275,508
2010	7,434	1,285,808	1,293,242
2011	7,546	1,303,677	1,311,223
2012	7,659	1,321,795	1,329,454

- national and state regulations that may affect PWC use or prices,
- alternative recreational activities available, and
- other infrequent events that may occur in a given year that affect visitation.

Although many of these factors are difficult to predict, a recent regulation enacted by the U.S. Environmental Protection Agency (EPA) in 1996 may affect PWC use nationally and in AMIS. The 1996 EPA rule for New Gasoline Spark-Ignition Marine Engines[6] (hereafter referred to as the 1996 EPA Marine Engine Rule) requires PWC (and other spark-ignition [SI] marine engine) manufacturers to reduce emissions by 75 percent from the 1998 model year until the 2006 model year (*Federal Register*, 1996). In their analysis of the rule, EPA predicted that the emissions from all of the regulated engines in use will decrease by approximately 75 percent from baseline emission levels by the year 2025. The delay in actual emission reductions for machines in use is due to the long lives of some marine engines. EPA predicts that complete fleet turnover for

[6]In 1996, EPA promulgated a rule to control exhaust emissions from new spark-ignition marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1998, with all PWC manufactured after 2006 required to be EPA emissions-compliant (i.e., to reduce hydrocarbon [HC] emissions by 75 percent from unregulated levels) (*Federal Register*, 1996).

some engines may not occur until 2050. However, EPA assumes that the life cycle for PWC is 10 years, considerably shorter than their assumptions for the life cycles of some of the other SI marine engines covered by the rule (*Federal Register*, 1996). According to the Personal Watercraft Industry Association (PWIA), PWC manufacturers have already reduced the emissions of PWC significantly, and many of the newer PWC models already comply with the 1996 EPA Marine Engine Rule (PWIA, 2002).

Without additional data, it is difficult to predict whether the assumptions used by NPS will bias the projections upward or downward.

It is also possible that publicity surrounding the proposed NPS PWC rules may have affected PWC use. PWC sales have been declining nationally over the past few years. However, the sales decline began in 1996, which is before NPS first proposed rules restricting PWC in national parks. This suggests that other factors also may be involved in the national recent sales decline. Nonetheless, it is possible that baseline PWC use would have been higher in the absence of recent negative publicity.

NPS identified the following additional uncertainties in the projections of baseline visitation:

- The estimate of 2001 PWC use represents the park's best estimate of use. However, AMIS staff have not conducted a rigorous count of PWC throughout the season.
- NPS estimates of total visitation to AMIS are based on traffic counters and an assumed group size of 3.5 people per party. To the extent that the actual average group size differs from 3.5 for overall visitation and from 3.67 for PWC users, visitation estimates for these groups may be biased upward or downward.
- NPS projects growth in non-PWC visitation based on population growth in areas that have been historically important as sources of visitors to the park. As discussed above, a number of factors could affect visitation in any one year or the trend in visitation over time. However, NPS believes that regional population growth, which should be related to economic conditions, represents the best available proxy for change in visitation.
- NPS makes assumptions about the number of former PWC users who will return in the future under the existing ban. These assumptions represent our best estimate, but the actual percentage of former PWC users that continue to visit the park for alternative recreation activities may be higher or lower.
- NPS expects that PWC use at AMIS will increase at a constant rate of 1.5 percent over time. This estimate is based on park staff members' observations. As explained

earlier, PWC registrations across the State of Texas declined sharply from 1998 to 2001. Consequently, future PWC use may be overestimated here. However, without further information, such as a formal count of PWC over time at AMIS, NPS assumes that the professional judgment of park staff is the most credible basis for predicting future PWC use.

2.3 ALTERNATE LOCATIONS FOR PWC USE NEARBY

The area of Lake Amistad within Mexico is outside of NPS jurisdiction and is available for PWC use. Alternate locations for PWC use may include Twin Butte and O.H. Ivie Reservoirs near the city of San Angelo, 130 miles to the north; International Falcon Reservoir approximately 250 miles to the southeast; and Choke Canyon Lake, approximately 200 miles to the east.

2.4 OTHER MAJOR SUMMER ACTIVITIES IN AMIS

Summer recreation activities in AMIS include: wildlife viewing, day hiking, bird watching, kayaking, canoeing, sailing, swimming, water-skiing, diving, visiting historic/archaeological sites, backpacking, camping, fishing, bass tournaments, and hunting. Few conflicts between PWC users and other visitors were reported, but NPS staff received some complaints from boat fishermen, bank fisherman, swimmers, and kayakers.

2.5 NATURAL RESOURCES AND LIKELY ECOLOGICAL IMPACTS OF PWC USE IN AMIS

The following section provides an assessment of the natural resources at AMIS and the potential impacts to park resources under the proposed PWC management alternatives. Interviews with AMIS personnel and information on PWC impacts reported in the literature provide the basis for this assessment. The following impact thresholds were established in order to describe the relative changes in resources:

Negligible: Impacts are not detectable, below resource standards or criteria, and within historical or baseline conditions of the park.

Minor: Impacts would be detectable but would be below the resource standards or criteria and within historical or desired conditions of the park.

Moderate: Impacts would be detectable but at or below the resource standards or criteria; however, conditions would be altered on a short-term basis.

Major: Impacts would be detectable and frequently altered from historical or baseline conditions in the park and would exceed resource standards or criteria slightly and singularly on a short-term and temporary basis.

Impairment: Impacts would be detectable and substantially and frequently altered from historical or baseline conditions in the park and would frequently exceed resource standards or criteria on a short-term and temporary basis. The impacts would involve deterioration of the park's resources over the long term, to the point that the park's purpose could not be fulfilled.

Details of this analysis, including guiding regulations and policies as well as methodologies and assumptions, are described in Personal Watercraft Use, EA (NPS, 2003) for AMIS.[7] Impacts have been assessed using current conditions (i.e., the PWC ban) as the baseline and comparing them with the conditions likely under the proposed alternatives (see Section 1.4).

2.5.1 Water Quality

Most research on the effects of PWC use on water quality focuses on the impacts of two-stroke engines and assumes that impacts caused by these engines also apply to the PWC powered by them. The typical conventional (i.e., carbureted) two-stroke PWC engine intakes a mixture of air, gasoline, and oil into the combustion chamber, expels exhaust gases from the combustion chamber, and discharges as much as 30 percent of the unburned fuel mixture as part of the exhaust (California Air Resources Board, 1999). At common fuel consumption rates, an average 2-hour ride on a PWC may result in the discharge of 3 gallons (11.3 liters) of fuel into the water (VanMouwerik and Hagemann, 1999).

[7]The EA assesses the potential impacts of the alternatives prior to the PWC ban.

Contaminants released into the environment due to PWC use include those present in the raw fuel itself and those that are formed during its combustion. Fuel used in PWC engines contains many hydrocarbons (HCs), including volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX), and methyl tertiary butyl ether (MTBE). Unburned PWC fuel does not contain appreciable levels of polycyclic aromatic HCs (PAHs), but several PAHs are formed as a result of its combustion (i.e., phenanthrene, pyrene, chrysene/benzo(a)pyrene, and acenaphthylene) (VanMouwerik and Hagemann, 1999). Other HCs that are not present in PWC fuel but are by-products of incomplete combustion include formaldehyde, acetaldehyde, diesel particulate matter (PM) and 1,3-butadiene (EPA, 1994).

Unburned fuel and combustion byproducts are released to the environment in PWC exhaust. Due to differences in chemical and physical characteristics, BTEX released into the water readily transfers from water to air, whereas most PAHs and MTBE do not. Therefore, water quality issues associated with BTEX in the water column are less critical than those associated with PAHs and MTBE (VanMouwerik and Hagemann, 1999).

Compounds released in water due to PWC use are known to cause adverse health effects to humans and aquatic organisms. Exhaust emissions from two-stroke engines specifically have been shown to cause toxicological effects in fish (Tjarnlund et al. 1995, 1996; Oris et al., 1998). Sunlight can further increase the toxic effect of PAHs to aquatic organisms (Mekenyan et al., 1994, Arfsten, Schaeffer, and Mulveny, 1996). Research evaluating the possible phototoxic effects of some PAHs to aquatic organisms has demonstrated that toxicity may vary due to a number of factors including length of exposure; turbidity, humic acid, and organic carbon levels; the location of the organism relative to the surface of the water or the sediment; and weather/PAH fate issues (NCER, 1999). For instance, increased turbidity or organic carbon tended to reduce toxicity, while increasing the length of exposure tended to increase toxicity and proximity to the surface (i.e., shallow waters) tended to increase toxicity.

New PWC engines, including direct-injection two-stroke engines and four-stroke engines, will decrease the amount of unburned fuel

that escapes with PWC exhaust and will result in decreases in emissions (VanMouwerik and Hagemann, 1999). As discussed in Section 2.2.4, EPA's 1996 Marine Engine Rule is expected to result in a 50 percent reduction of current HC emissions from these spark-ignited engines by 2020 and a 75 percent reduction in HC emissions by 2025 (*Federal Register*, 1996).

Baseline Water Quality Conditions at AMIS

According to the AMIS EA (2003), water quality data has been collected for standard pollutants in Lake Amistad and the principal drainages to the reservoir. The EA reports that 16 water quality parameters exceeded a screening benchmark in at least one sample from at least one monitoring station. Dissolved oxygen, pH, chloride, turbidity, cadmium, copper, lead, mercury, and zinc exceeded ecological benchmarks, and nitrate, chloride, sulfate, bacteria, barium, beryllium, cadmium, chromium, lead, mercury, and nickel exceeded human health benchmarks.

Because PWC are currently banned from AMIS, they have no impact on water quality.

Potential Impact of PWC Use on Water Quality Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation. Overall, the impact of PWC use on water quality at AMIS was very limited. This is due to the fact that water quality is affected by non-PWC related stressors, including other watercraft. Negligible adverse effects to water quality relative to baseline are anticipated under this alternative. All pollutant loads were below the benchmark and criteria during previous PWC use. In addition, improvements to water quality from reduced emissions are likely to be gradual as manufacturers meet EPA requirements to improve the efficiency of engines by the year 2006 and conventional engines are replaced with direct injected two-stroke or four-stroke models. This alternative would not result in an impairment of the water quality resource.

Alternative B: Reinstate PWC Use Under a Special Regulation, But Limit Use Areas. Negligible adverse effects are expected under this alternative for the reservoir and Rio Grande area. Beneficial impacts are expected to the Devils River and San Pedro Canyon as a result of no PWC use. Improvements to water quality from reduced emissions are likely to be gradual as manufacturers meet EPA requirements to improve the efficiency of engines by the year 2006 and conventional engines are replaced with direct injected two-stroke or four-stroke models. This alternative would not result in an impairment of the water quality resource.

Alternative C: No-Action Alternative—Continue PWC Ban. No impacts to water quality from PWC would occur within AMIS if the ban continued.

2.5.2 Air Quality

Air quality and visibility can be impacted by emissions from two-stroke engines such as PWC motors. Emissions from PWC in national parks are one of many potential (albeit, relatively small) sources of these air quality and visibility impairments.

Recreational marine engines, including PWC and outboard motors, contribute approximately 30 percent of national non-road engine emissions and are the second largest source of non-road engine HC emissions nationally (*Federal Register*, 1996). According to the results of a 1990 inventory of emissions in California, watercraft engines were estimated to account for 141 tons of smog-forming reactive organic gases (ROG) 1,063 tons of carbon monoxide (CO), and 31 tons of nitrogen oxides (NOx) emitted per day (Kado et al., 2000). A study comparing emissions from conventional and direct-injected two-stroke engines with four-stroke engines found that the new four-stroke engine has considerably lower emissions of PM, PAHs, and genotoxic activity (Kado et al., 2000). Based on a comparison with a typical 90-horsepower engine, it is estimated the ban of conventional two-stroke engines would result in a four-fold decrease in smog-forming pollution per engine (VanMouwerik and Hagemann, 1999).

Up to one-third of the fuel delivered to conventional two-stroke engines goes unburned and is discharged as gaseous hydrocarbons.

Although PWC engine exhaust is usually routed below the waterline, a portion of the exhaust gases is released to the air and may affect air quality. Up to one-third of the fuel delivered to conventional two-stroke engines goes unburned and is discharged as gaseous HCs; the lubricating oil is used once and is expelled as part of the exhaust, and the combustion process results in emissions of air pollutants such as HCs (including VOCs [e.g., BTEX and MTBE] and PAHs), NOx, PM, and CO (Kado et al., 2000). PWC also contribute to the formation of ozone (O_3) in the atmosphere, which is formed when HCs react with NOx in the presence of sunlight (EPA, 1993). (See Section 2.5.1 for further discussion of burned and unburned constituents of PWC emissions.)

These compounds are known to cause adverse health effects in both human and plant life. They may adversely affect park visitor and employee health, as well as sensitive park resources. Ozone causes respiratory problems in humans, including coughing, airway irritation, and chest pain during inhalation. Ozone is also toxic to sensitive species of vegetation. It causes visible foliar injury, decreases plant growth, and increases plant susceptibility to insects and disease (EPA, 1993).

CO can interfere with the oxygen carrying capacity of blood, resulting in lack of oxygen to tissues. NOx and PM emissions associated with PWC use can also degrade visibility. Adverse health effects have been associated with airborne PM, especially less than 10 •m aerodynamic diameter (PM10) (Kado et al., 2000). NOx also contributes to acid deposition effects on plants, water, and soil.

Baseline Air Quality Conditions at AMIS

General long-term air quality monitoring occurs at Big Bend National Park, 200 miles to the west. AMIS is designated as a Federal Class II air quality area. Air quality is generally good. Because PWC are currently banned from AMIS, they have no impact on air quality.

Potential Impact of PWC Use on Air Quality Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation. Prior to PWC ban, air quality standards were being met. NPS anticipates that air

quality under Alternative A would continue to be in attainment with national ambient air quality standards. Negligible changes in air quality relative to baseline are anticipated under this alternative. Improvements to air quality from reduced emissions are likely to be gradual as manufacturers meet EPA requirements to improve the efficiency of engines by the year 2006 and conventional engines are replaced with direct injected two-stroke or four-stroke models. This alternative would not result in impairment of air quality or air quality related values.

Alternative B: Reinstate PWC Use Under a Special Regulation, But Limit Use Areas. Impacts under this alternative are expected to be similar to Alternative A, except that improvements in air quality may occur sooner in some areas of AMIS because regulations would limit PWC use there. However, given the fact that other stressors affect local waters, no changes in air quality are anticipated under this alternative. This alternative would not result in impairment of air quality or air quality related values.

Alternative C: No-Action Alternative—Continue PWC Ban. No impacts to air quality or related values from PWC would occur within AMIS if the ban continued

2.5.3 Soundscapes

Natural sounds generally include the naturally-occurring sounds of winds in the trees, calling birds, and the quiet associated with still nights.

PWC emit up to 105 dB per unit at 82 feet, which may disturb park users (visitors and residents). NPS has established a noise limit of 82 dB at 82 feet. Noise from PWC may be more disturbing than noise from a constant source at 90 dB due to rapid changes in acceleration and direction of noise (EPA, 1974) and their ability to be driven in shallow water close to the shoreline. However, the newer, compliant models of PWC may be up to 50 to 70 percent quieter than the older models (PWIA, 2002a).

Baseline Soundscape Conditions at AMIS

One aspect of experiencing AMIS's resources is the ability to hear the sounds associated with its natural resources, often referred to as "natural sounds" or "natural quiet." Natural sounds generally include the naturally-occurring sounds of winds in the trees, calling birds, and the quiet associated with still nights. "Noise" is defined as unwanted sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them.

Typical sounds at AMIS include waves, wind, visitors talking, motorboats, and road noise from automobiles in the recreation area. High-use areas, such as around boat launches, have higher ambient noise levels, particularly for boats launching and landing. Because PWC are currently banned from AMIS, they have no impact on soundscapes.

Potential Impact of PWC Use on Soundscape Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation. Noise from PWC would have short-term, minor, adverse impacts at most locations throughout the use season, and short-term, minor to moderate, adverse impacts along the reservoir shoreline and at shoreline camping locations because PWC could be heard occasionally throughout the day during peak visitor season. Impact levels would be related to the number of PWC, as well as the sensitivity of other visitors. Over the long term, newer engine technologies could result in reduced noise levels.

Cumulative noise impacts from PWC, motorboats, and other visitors would be heard occasionally throughout the day. For the most part, natural sounds would still predominate at most locations within the national recreation area. The highest sound impacts would occur near boat launches, beaches, and marinas. This alternative would not result in impairment of the AMIS soundscape.

Alternative B: Reinstate PWC Use Under a Special Regulation, But Limit Use Areas. Impacts under this alternative are expected to be similar to Alternative A, although reduced PWC-generated noise would be expected in areas of AMIS because regulations would limit PWC use there. PWC noise would have short-term, minor adverse impacts at most locations throughout the season, and minor to moderate, adverse impacts along the reservoir shoreline. Eliminating PWC use in specific areas would have beneficial impacts relative to Alternative A since PWC engines would not be heard and there would be less impact to residents and quiet uses in these areas. Over the long term, newer engine technologies could result in reduced noise levels. However, given the fact that other factors affect local soundscape conditions such as other motorized

watercraft, this alternative would not result in impairment of the AMIS soundscape.

Alternative C: No-Action Alternative—Continue PWC Ban. No impacts to the natural soundscape from PWC would occur within AMIS if the ban continued.

2.5.4 Wildlife and Wildlife Habitat

PWC may affect wildlife by interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success.

PWC may affect wildlife by interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success. These effects are thought to be caused by a combination of PWC speed, noise, and ability to access sensitive areas, especially in shallow water (WDNR, 2000).

PWC potentially can access sensitive shorelines and disturb riparian habitats critical to wildlife. When run in very shallow water, PWC can disturb the substrate, including aquatic plants and benthic invertebrates, and at certain times of year, fish breeding and nursery areas. Furthermore, water quality degradation caused by PWC can affect migratory avian species in the area.

Waterfowl and nesting birds may be particularly sensitive to PWC because of their noise, speed, and unique ability to access shallow water. This may force nesting birds to abandon eggs during crucial embryo development stages, keep adults away from nestling, thereby preventing them from defending the nest against predators, and flush waterfowl from habitat, causing stress and associated behavior changes (WDNR, 2000; Burger, 1998; Rodgers and Smith, 1997).

Baseline Wildlife and Wildlife Habitat Conditions at AMIS

Mammals commonly found in AMIS include coyote, whitetail deer, collared peccary, ringtail, raccoon, skunk, jackrabbit, cottontail, and rock squirrel. Various reptiles inhabit the area including the poisonous diamondback and rock rattlesnakes. Common birds include the vulture, raven, quail, mourning dove, white-winged dove, sparrow wren, and various types of water birds, including the great blue heron and several species of ducks. Principal fish species are bass (largemouth, smallmouth, and striped), channel catfish, crappie, sunfish, and carp.

Lake Amistad is one of the most popular fishing locations in the region. Fish stocked in Lake Amistad by the Texas Parks and Wildlife Department include Florida bass, smallmouth bass, walleye, striped bass, and striped bass hybrids. In 1972, Lake Amistad was ranked the second lake in the State of Texas for average fish harvest, fourth lake in the sate for maximum fish harvest, and sixth largest lake in the state by size.

Because PWC are currently banned from AMIS, they have no impact on wildlife or wildlife habitat at AMIS.

Potential Impact of PWC Use on Wildlife Habitat Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation. Negligible impacts on wildlife and wildlife habitat relative to baseline are predicted, as a result of the distance PWC users are required to operate from the shoreline. The effects from PWC speed and noise or proximity to wildlife would be limited because PWC users must operate at no-wake speeds within 50 feet of the shore. In addition, few wildlife species occur in open water, where speeds are higher.

NPS staff indicated that there was no noticeable impact of PWC on wildlife or wildlife habitat at AMIS when PWC were allowed. There have been no documented cases of PWC deliberately harassing or chasing birds or wildlife in the lake. There is no documented evidence of water or air quality impacts to wildlife in AMIS. Implementation of this alternative would not result in an impairment to wildlife or wildlife habitat.

Alternative B: Reinstate PWC Use Under a Special Regulation, But Limit Use Areas. Impacts under this alternative are expected to be similar to Alternative A, except there would be a reduction in overall impacts caused by PWC use, due to limited areas of use. However, because there are no known impacts from PWC to wildlife and aquatic habitat, negligible impacts to wildlife species or habitats are anticipated under this alternative. Implementation of this alternative would not result in an impairment to wildlife or wildlife habitat.

Alternative C: No-Action Alternative—Continue PWC Ban. No impacts to the wildlife or wildlife habitat from PWC would occur within AMIS if the ban continued.

2.5.5 Threatened, Endangered, and Special Concern Species

PWC may affect threatened, endangered, and special species of concern in the same manner they affect other wildlife, such as by disturbing or degrading the quality of habitat, interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success.

Baseline Conditions of Threatened, Endangered, and Special Concern Species at AMIS

Bald eagles are occasionally observed in AMIS during the winter feeding on fish. They do not nest in AMIS or remain for extended periods of time. The peregrine falcon has been sighted while migrating, but no known nesting sites are located within AMIS.

The interior least tern nests on islands in AMIS in early May through late August. The terns do not nest on the same islands each year, as the islands available to the terns change each year as a result of fluctuating water levels in the lake. There are several federal- and state-listed fish species in the vicinity of AMIS, including the Pecos gambusia and the Pecos bluntnose shiner. These fish are only found in the upper reaches of Lake Amistad and its tributary rivers and streams where conditions similar to pre-inundation exist.

Because PWC are currently banned from AMIS, they have no impact on threatened, endangered, or special concern species at AMIS.

Potential Impact of PWC Use on Threatened and Endangered Species Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation. No changes in wildlife numbers or habitats relative to baseline are anticipated under this alternative. NPS staff have not observed any disturbances to the birds from PWC or other watercraft when PWC were allowed at AMIS. There have been no documented cases of PWC deliberately harassing or chasing birds or wildlife in the lake. Reinstating PWC use would have no effect or would not likely

adversely affect any federal or state listed species, since the identified species are either not present as permanent residents, do not have preferred habitat in PWC use areas, or are not normally accessible. This alternative would not result in an impairment of threatened, endangered, or special concern species.

Alternative B: Reinstate PWC Use Under a Special Regulation, But Limit Use Areas. Impacts under this alternative are expected to be similar to Alternative A, except restricting PWC in several of the more upstream river areas and limiting their access would reduce the chances of adverse impacts to those species that utilize these areas more. However, because there are no known impacts from PWC to wildlife and aquatic habitat, no noticeable improvements to wildlife species or habitats are anticipated under this alternative. This alternative would not result in an impairment of threatened, endangered, or special concern species.

Alternative C: No-Action Alternative—Continue PWC Ban. No impacts on threatened, endangered, or special concern species from PWC would occur within AMIS if the ban continued.

2.5.6 Shorelines and Shoreline Vegetation

Because of their shallow draft, PWC are able to access areas where most other watercraft cannot go. As a result, PWC may land on the shoreline, allowing visitors to access and disturb areas where sensitive plant species exist. In addition, wakes created by PWC may affect shoreline and cause erosion. Some research shows that PWC may create a wake at slower speeds than larger boats and when driven close to shoe their wakes can lead to erosion (WDNR, 2000).

PWC use can increase turbidity in some waters, which may result in decreased sunlight available for submerged aquatic vegetation (SAV) and may subsequently limit vegetation growth and ultimately decrease water quality. PWC use in shallow, supporting SAV may reduce its value as important habitat for animals, including fish, by redistributing plants and organisms that use these grasses for habitat.

PWC can access areas where most other watercraft cannot go due of their shallow draft and thus may affect shoreline and shoreline vegetation. Therefore, PWC may land on the shoreline, allowing visitors to access and disturb areas where sensitive plant species exist.

Baseline Condition of Shorelines and Shoreline Vegetation at AMIS

The lake level has fluctuated greatly since the dam was completed in 1968. According to NPS staff, the lake level remained 7 feet above the normal conservation pool for an extended period of time, effectively killing off all native vegetation around the shoreline. In 2002, the lake level was over 50 feet below the normal conservation pool. Because PWC are currently banned from AMIS, they have no impact on shorelines or shoreline vegetation at AMIS.

Potential Impact of PWC Use on Shoreline and Shoreline Vegetation Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation. The lake level has been below the normal conservation pool since 1993, so wave action from PWC disturbance has had no impact on shoreline vegetation at Lake Amistad. Negligible adverse impacts are predicted over the short and long term and no perceptible changes to plant community size, integrity, or continuity are predicted, now or in the future. This alternative would not result in an impairment of shorelines or shoreline vegetation.

Alternative B: Reinstate PWC Use Under a Special Regulation, But Limit Use Areas. Impacts under this alternative are expected to be similar to Alternative A, except PWC restrictions would result in beneficial impacts to shoreline vegetation in the Pecos River, Rio Grande north of buoy 28, Devils River north of buoy P, and San Pedro Canyon east of buoy SPC-1. This alternative would not result in an impairment of shorelines or shoreline vegetation.

Alternative C: No-Action Alternative—Continue PWC Ban. No impacts to shoreline vegetation from PWC would occur within AMIS if the ban continued.

2.5.7 Cultural Resources

Prehistoric archaeological sites at AMIS represent occupations that began approximately 10,000 BC and extended until the days of Spanish conquest. These sites reflect adaptation to the arid or semiarid environment and a life dependent on hunting and gathering. Evidence can be found of prehistoric occupation by big game hunters of the Paleo-Indian stage (at least 9,000 years ago),

through the Archaic stage (7,000 BC to 1,000 AD) and post-Archaic stage (1,000 AD to 1,600 AD), and into the early part of the Historic stage (1,600 AD and on). Approximately 600 sites are known within AMIS and 1,000 in the vicinity (in the United States), some of which were studied and excavated prior to inundation.

Unique and excellently preserved pictographs (Native American rock paintings) adorn the walls of many of the rock shelters in AMIS. Many of these sites are of national significance. Many of the pictograph sites were located and recorded between 1936 and 1940. Intensive field work was renewed in 1958 and continued until 1970, when the Texas Archaeological Salvage Project did surveys and excavation prior to and during the reservoir's filling.

From 1991 through 1993, extensive surveys have been carried out in AMIS and vicinity to fulfill the requirements of the Congressional mandate designating AMIS a national recreation area (1990) and requirements of the National Archaeological Survey Initiative program, which began in 1991. Four districts and two sites are currently listed in the National Register of Historic Places.

The lake level has fluctuated greatly since the dam was completed in 1968. The lake level has been below the normal conservation pool since 1993, and in 2002, the lake level was over 50 feet below the normal conservation pool. The low lake level has exposed many archaeological sites that were previously submerged. Wave action created by watercraft can cause accelerated shoreline erosion. Because PWC are currently banned from AMIS, they have no impact on cultural resources at AMIS.

Potential Impact of PWC Use on Cultural Resources Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Prior to November 2002, Under a Special Regulation. Despite the low lake levels, there are no documented evidence of PWC-related disturbances to cultural resources prior to the ban. However, PWC use could have minor adverse impacts on potentially listed archaeological sites and submerged resources from possible illegal collection and vandalism. However, no changes to cultural resources relative to baseline are anticipated under this alternative. Implementation of this alternative would not result in an impairment of cultural resources.

Alternative B: Reinstate PWC Use Under a Special Regulation, But Limit Use Areas. Impacts under this alternative are expected to be similar to Alternative A, except in areas where PWC would be prohibited. The areas excluding PWC use would receive beneficial effects to cultural resources. Implementation of this alternative would not result in an impairment of cultural resources.

Alternative C: No-Action Alternative—Continue PWC Ban. No impacts to cultural resources from PWC would occur within AMIS if the ban continued.

2.6 ECONOMIC ACTIVITY IN THE SURROUNDING COMMUNITIES

The closest town to AMIS is Del Rio, Texas, located 8 miles southeast of the dam. The closest major city is San Antonio, approximately 150 miles away and a major source of visitors to AMIS. Tourism and nearby Laughlin Air Force Base are major contributors to employment and income in Del Rio. In addition to establishments in Del Rio, businesses along U.S. Highway 90 between San Antonio and Del Rio may be affected by changes in the number of visitors to AMIS.

AMIS has two main concession marinas, one of which provides PWC rentals and gas and one of which provides only gas. NPS identified one PWC sales/service shop, one PWC storage facility, one establishment providing service and selling PWC accessories, and three additional shops selling accessories in Del Rio. Before the ban, NPS contacted each of these businesses to solicit input on the potential impacts of PWC restrictions. Because the nearest substitute area for water-based motorized recreation is more than 130 miles away, any reinstatement of PWC use in AMIS will likely have a large impact on the PWC-related revenues of these firms. However, each of these establishments derives the majority of its revenue from non-PWC related sources. The PWC dealership reported that PWC-related revenue represented 25 percent of its total revenue, and the other seven businesses all reported that PWC-related revenue comprised 10 percent or less of their totals. The diversity of their revenue sources may have limited the impact of PWC-related revenue reductions that resulted from the existing ban on PWC use in AMIS. NPS based the small business analysis (see Section 5) on the data provided by the individual small businesses

potentially affected by PWC restrictions in AMIS. This information suggests that reinstating PWC is not likely to have large positive benefits for local businesses relative to baseline conditions.

Because PWC users account for a very small fraction of economic activity in the region, it is very unlikely that there will be any measurable incremental impacts on the region's economy.

In addition to businesses that provide goods and services directly related to PWC use, lodging establishments, restaurants, gas stations, and other retail stores in the area could be affected if PWC use is reinstated. These establishments could be affected if the reinstatement results in changes in visitation to the park and surrounding area. Many of the aforementioned businesses deal with houseboat as well as PWC clients and, insofar as there is an overlap between the two, impacts of PWC regulation on local economic activity may be greater or lesser than would be expected for changes in PWC business alone. However, because PWC users account for a very small fraction of economic activity in the region, it is very unlikely that there will be any measurable incremental impacts on the region's economy. The estimated regional economic impacts are discussed in more detail in Section 3.

3 Economic Impact Analysis of Reinstating PWC Use in Amistad National Recreation Area

Reinstating PWC use in AMIS may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales tax revenue. Generally, allowing PWC use in the park is expected to increase economic activity in the areas surrounding the park. However, the incremental impacts under Alternatives A and B are expected to be very small relative to the size of the local economy.

Historically the percentage of total visitors to AMIS that used PWC has been small. Prior to the November 2002 ban, it is estimated that only about 0.57 percent of visitors used PWC in the park. Because PWC use was not necessarily their primary reason for visiting AMIS, many former PWC users are likely to continue visiting the park under the ban. However, those park visitors who had previously used PWC in AMIS are negatively affected by the current ban on PWC use in AMIS. These visitors would also potentially be positively affected by any change in PWC regulations in AMIS that reinstated PWC use in the park. Not only are PWC users potentially affected by any change in PWC regulations, but businesses, including PWC sales and rental shops, restaurants, and other establishments that provide services to those visitors may be affected as well.

A variety of economic analyses can be conducted to provide valuable information for policy makers trying to understand the effects of alternative policies. The type of analysis that is most appropriate for examining a particular policy or action depends on the decision under consideration. In the context of examining the impacts of regulation, two of the most important types of economic analysis are economic impact analysis and benefit-cost analysis. These types of analyses are often confused because they both estimate the economic "benefits" associated with a particular

policy. However, an economic impact analysis typically examines the effect of a change in policy on the economy of a particular region, while a benefit-cost analysis focuses on the change in economic efficiency resulting from a change in policy. Economic impact analyses trace the flows of spending associated with the affected industries to identify changes in sales, income, jobs, and tax revenues resulting from a policy action, and for AMIS is addressed in this section. Benefit-cost analysis, on the other hand, focuses primarily on changes in social welfare, and is examined in Section 4. Unlike economic impact analysis studies, benefit-cost analysis includes both market and nonmarket values (Stynes, 2000).

Reinstating PWC use in AMIS is likely to have a positive economic impact on the surrounding area. The primary economic impacts associated with the PWC management alternatives are the potential increases in sales, profits, and employment of PWC rental and sales establishments, hotels, restaurants, and other businesses in the area surrounding the park, relative to baseline conditions. The incremental impact of each alternative depends in large part on the way that affected individuals and firms responded to the ban on PWC use in AMIS.[1] To the extent that local businesses that relied on PWC users prior to the ban were able to provide substitute products and services, they may have been able to reduce the negative impacts on their profits. In addition, although it is expected that PWC users would decrease their overall visitation to the park because of the ban, they will not necessarily stop visiting the area altogether, especially if PWC use is not their primary activity. It is also possible that visitation to AMIS by non-PWC users has increased under the ban if the absence of PWC users makes park visitation more enjoyable for this group of people, although NPS is unable to quantify this impact because of a lack of data. The more that producers and consumers were able to make adjustments to mitigate the negative impacts of the ban, and the more that non-

[1]Because PWC were not banned in AMIS until November 2002, but the most recent data available were collected in 2001, no data regarding changes in PWC visitation or business revenues in response to the ban are available.

PWC users increase their visitation under the ban, the smaller the incremental positive impacts of reinstating PWC use in AMIS.[2]

Economic impact analyses tend to overstate the impacts associated with rules such as the management alternatives for PWC use in AMIS because they do not account for behavioral changes that may mitigate impacts. However, these analyses are still very important to policy makers because they provide an estimate of the impact on the local area most directly affected by the regulation. In addition to the total impacts associated with a regulatory action, the distribution of those impacts is important. Because benefit-cost and economic impact analyses have different emphases and different final results, but both provide useful information for measuring the impact of different PWC management alternatives, both types of analyses are presented in this report. This section describes an economic impact analysis of the proposed alternatives, while Section 4 presents a benefit-cost analysis.

The majority of the economic impacts are expected to be concentrated in Val Verde County, the county that surrounds the park on the United States side, and particularly in the city of Del Rio. There may also be economic impacts along U.S. Highway 90, which connects AMIS with San Antonio, a major source of weekend and holiday vacationers. Projected reductions in economic activity are compared to the size of the local economy to put the impacts in perspective.

3.1 SCENARIOS EXAMINED IN THIS REPORT

NPS estimates that about 6,249 visitors used PWC during 2001, accounting for only about 0.57 percent of annual visitation.

As described in Section 2.2, PWC users accounted for a small fraction of total visitation to AMIS prior to the ban in November 2002. NPS estimates that approximately 6,249 visitors used PWC during 2001, accounting for only about 0.57 percent of annual visitation. Baseline visitation (i.e., with PWC being banned from AMIS) was projected through 2012 using a starting point of average annual visitation over 5 years, 1997 to 2001. Baseline visitation was then assumed to increase at a rate equal to the weighted 1990–

[2] A decrease in expenditures for substitute activities in the AMIS region relative to baseline conditions in response to allowing PWC use to resume would partially offset any positive regional impacts associated with Alternatives A and B. There may also be reallocation of revenue among businesses.

2000 average annual population growth rates in Val Verde County, in which AMIS is located, and in the city of San Antonio.[3] Although there would be no PWC use in AMIS in 2003–2012 under baseline conditions, it was assumed that some fraction of the former PWC users (85%) would continue to visit the AMIS region to enjoy other recreational activities.

PWC users are expected to change their visitation to AMIS in response to changes in management of PWC use in the park. To estimate the magnitude of the resulting economic impacts, NPS constructed scenarios for the regulatory alternatives based on the available information. Under Alternative A, it is expected that visitation would be higher than under the baseline, continuing at projected values based on visitation in years prior to a ban on PWC use. For Alternative B, it is expected that PWC users will increase their visitation to the park relative to baseline conditions, but that visitation would not return to the levels that would have prevailed in the absence of the ban due to additional geographic restrictions and new safety measures. Under Alternative C, it is expected that visitation will not change relative to baseline projections because PWC management would not change relative to current conditions.

It is assumed that people who continue to visit the AMIS area will have the same spending patterns as baseline conditions, except that some of them will resume renting or purchasing PWC under Alternatives A and B. It is possible that former PWC users would have continued to visit the park to engage in other summer recreational activities and would have increased expenditures on those activities, but because there is no information on the amount these users might spend, this potential spending increase is not included in the analysis. In addition, as mentioned above, non-PWC users may have increased their visitation in response to the ban on PWC. To the extent that visitation by non-PWC users has increased following the ban on PWC use, the number of non-PWC users visiting this area may decrease relative to baseline because

[3]It would be preferable to use population projections rather than assuming that population growth would continue at historical levels. However, the Census Bureau only provides population projections at the state and national levels. Because Texas is a very large state that is likely to have a large variance in growth rates between regions within the state, NPS believes that the recent historical population growth rate in the local region is a more appropriate basis for projecting population than the projected growth rate for Texas.

potential increases in noise and pollution resulting from changes in PWC management in AMIS could decrease their enjoyment of the area.[4] However, neither the potential increase in non-PWC visitation under baseline conditions nor the potential decrease in non-PWC visitation were included in the analysis because of uncertainties in quantifying changes in visitation for this group of people and the associated changes in expenditure.

To better develop the economic impact scenarios, NPS interviewed marinas, PWC sales and rental shops, providers of guest services such as lodging, and convenience/bait stores identified in the area concerning the expected impacts on those businesses. According to interview data, the ban was estimated to have caused at, or very close to, 100 percent losses in PWC-related revenue. Reinstatement of PWC use would return PWC-related revenue to pre-ban levels. Compared to baseline conditions, Alternatives A and B would result in increases in PWC-related revenue. The predicted impacts for local businesses are discussed in detail in Section 5.

Based on information collected from local businesses and AMIS park staff, scenarios were developed for each of the proposed regulatory alternatives. The three primary scenarios that were analyzed for AMIS are summarized in Table 3-1. For Alternatives A and B, NPS assumed that PWC use would be increasing at a 1.5 percent annual rate without regulation based on park staff estimates (NPS, 2003). Because the nearest substitute recreational area similar to AMIS (excluding the Mexican side of the lake) is 130 miles away, it was assumed that 85 percent of the visitors projected to stop using PWC in AMIS would continue to visit for alternative recreational activities. For visitors who do not currently use PWC, visitation to the park was assumed to be increasing at an annual rate equal to the average annual population growth rate over the last decade for Val Verde County and San Antonio (weighted equally to reflect approximate shares of visitation). That growth rate was 1.39 percent, which is significantly higher than the national growth rate of 0.9 percent over that time period.

[4]This could result from an increase in the number of visitor-days for current non-PWC users and/or visitation by people who did not previously travel to the park.

Table 3-1. Assumptions Used in Analyzing Economic Impacts of AMIS Regulatory Alternatives for PWC Use

	Alternative A	Alternative B	Alternative C
Annual percentage change in the number of visitors using PWC in AMIS that would have occurred in the absence of a ban[a]	1.50%	1.50%	NA
Baseline annual percentage change in non-PWC user visitation to AMIS[b]	1.39%	1.39%	1.39%
Percentage of visitors who used PWC in AMIS prior to the ban who are expected to continue visiting the park for other activities[c]	NA	NA	85%
Percentage of visitors using PWC in AMIS prior to the ban who will resume PWC use in AMIS as a result of reinstatement[c]	100%	90%	0%
Percentage of visitors renting PWC for use in AMIS prior to the ban who will resume renting PWC for use in AMIS as a result of reinstatement[c]	100%	90%	0%
Percentage of visitors purchasing PWC in the AMIS region prior to the ban who will continue to purchase PWC in the AMIS region[c]	100%	90%	0%

[a]National Park Service (NPS). 2003. *Amistad National Recreation Area Personal Watercraft Use Environmental Assessment*. Washington, DC: National Park Service.

[b]U.S. Bureau of the Census (Census Bureau). 2002. "County and City Data Book: 2000." <http://www.census.gov/prod/www/ccdb.html>. As obtained in August 2002.

[c]NPS estimates.

It was assumed that PWC visitation, rental and storage revenues, and sales would increase to 100 percent of pre-ban levels under Alternative A and to 90 percent of pre-ban levels under Alternative B and remain unchanged under Alternative C.

It was assumed that PWC visitation would return to 100 percent of pre-ban levels under Alternative A, to 90 percent of pre-ban levels under Alternative B, and remain unchanged under Alternative C. PWC rental and storage revenues are assumed to increase to the same levels as PWC visitation. PWC sales are assumed to increase to 100 percent of pre-ban levels under Alternative A, 90 percent of pre-ban levels under Alternative B, and to remain unchanged under Alternative C, given the lack of nearby substitutes for water-based motorized recreation.

The scenarios outlined in Table 3-1 are used in Section 3.2 to provide estimates of potential economic impacts resulting from reinstating PWC use in AMIS. The fewer former PWC users who would have continued to visit AMIS to engage in alternative activities under the ban, the larger the overall impact of reinstating PWC use, other things being equal. Thus, the overall economic

impact of this regulation depends on the willingness of former PWC users who are prevented by the ban from using PWC in the park to continue visiting AMIS to engage in alternative recreational activities.

3.2 ECONOMIC IMPACT OF PWC REGULATIONS ON LOCAL ECONOMIES

Generally, reinstating the use of PWC in AMIS is expected to increase economic activity slightly in the areas surrounding the park.

The proposed regulations may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales tax revenue. Generally, reinstating the use of PWC in AMIS is expected to increase economic activity slightly in the areas surrounding the park. The following sections describe the estimated economic impacts on the region where the majority of the effects from increased visitation to AMIS will be felt.

3.2.1 Effect of Management Alternatives on AMIS Visitation

Alternatives A and B are expected to lead to an increase in the number of visitor-days spent in AMIS compared with the projected baseline, as shown in Table 3-2. This anticipated increase in the number of visitor-days is primarily due to the expectation that the majority of people who visited to use their PWC prior to the ban will now return to the park because PWC use has been reinstated. The actual increase in park visitation depends on several factors. Some people who previously used PWC in AMIS may choose to continue visiting the park to enjoy alternative summer activities available within AMIS, such as hiking, boating, and fishing. As mentioned earlier, visitation by non-PWC users may have increased in response to the PWC ban. Thus, if PWC are reinstated, visitation by non-PWC users is likely to decline to levels that would have occurred in the absence of the PWC ban because reinstating PWC may create a less enjoyable outdoor experience for some members of this group. This decrease in visitation would partially offset the increase in PWC users. However, neither the potential increase in visitation by non-PWC users in response to the PWC ban nor the expected decrease in visitation by non-PWC users if PWC are reinstated are quantified in this analysis because the extent to which non-PWC users would change their visitation is unknown.

Table 3-2. Incremental AMIS Visitation under Regulation Relative to Baseline Conditions[a]

	Alternative A			Alternative B			Alternative C[b]		
Year	Former PWC Users that Resume PWC Use[c]	Non-PWC Users[d]	Total Visitation	Former PWC Users that Resume PWC Use[c]	Non-PWC Users[d]	Total Visitation	Former PWC Users that Resume PWC Use[c]	Non-PWC Users[d]	Total Visitation
2003	6,699	–5,694	1,005	6,029	–5,694	335	—	—	—
2004	6,799	–5,694	1,105	6,119	–5,694	425	—	—	—
2005	6,901	–5,694	1,207	6,211	–5,694	517	—	—	—
2006	7,005	–5,694	1,311	6,304	–5,694	610	—	—	—
2007	7,110	–5,694	1,416	6,399	–5,694	705	—	—	—
2008	7,216	–5,694	1,522	6,495	–5,694	801	—	—	—
2009	7,325	–5,694	1,631	6,592	–5,694	898	—	—	—
2010	7,434	–5,694	1,741	6,691	–5,694	997	—	—	—
2011	7,546	–5,694	1,852	6,791	–5,694	1,098	—	—	—
2012	7,659	–5,694	1,965	6,893	–5,694	1,199	—	—	—

[a]NPS generated these estimates using the assumptions in Table 3-1.

[b]NPS assumed that there would be no change in visitation relative to baseline conditions under Alternative C because this alternative maintains the ban on PWC use in AMIS.

[c]This column includes those visitors who use PWC in the park prior to implementation of the ban on PWC use in AMIS and who would resume PWC use in the park if it were authorized under Alternative A or B. It includes both former PWC users who were assumed to visit the park for other activities during the ban (who are recategorized from non-PWC users to PWC users in this table) and former PWC users who were assumed to stop visiting the park if they are unable to use their PWC (their return to visiting the park leads to a net increase in visitation relative to baseline for Alternatives A and B).

[d]These are the former PWC users who were assumed to continue to visit the park to engage in alternative activities under baseline conditions. If PWC use is authorized, these visitors are expected to resume using PWC in the park and are counted as PWC users rather than non-PWC users in the table.

3.2.2 Impact of Management Alternatives on Local Business Output

As a result of the incremental increase in visitation to the AMIS area expected under Alternatives A and B, there will be a corresponding increase in the value of local business output. The primary sectors affected by increases in summer visitation are the tourism sectors, including PWC sales and rental shops, hotels, restaurants, and retailers. As discussed in Appendix A, although the direct impact of

an increase in visitor spending is primarily felt in these sectors, many additional sectors of the economy will be affected to some extent through secondary impacts. NPS focuses on the impacts estimated for reinstating visitation in 2003, the first year after implementation of the selected alternative for PWC management. Impacts in subsequent years will be similar although they are expected to become larger over time as a result of the projected increase in incremental visitation after 2003 (see Table 3-2). The impact in all years is expected to be very small relative to the size of the local economy.

To estimate spending impacts, it is necessary to obtain spending information for use with this study's estimates on changes in visitation. No data are available concerning the reduction in the number of PWC rented, sold, serviced, and stored annually that would result from changes in PWC regulations in AMIS. Thus, NPS used information from local businesses on their baseline revenues and the projected increase in PWC sales, rentals, and storage shown in Table 3-1 to project the total increases in revenue for these categories.

No data are available concerning the increase in the number of PWC rented, sold, and serviced annually that would result from reinstatement in AMIS. Thus, NPS used information from local businesses on their pre-ban revenues and the projected increases in PWC sales, rentals, and storage to project the total increase in revenue for these categories.

For categories of tourism spending other than direct spending on PWC, spending profiles were used in conjunction with estimated changes in visitation to determine the total change in park-related expenditures. The Money Generation Model (MGM2), which is often used by NPS to estimate local economic impacts associated with national park visitation, provides generic spending profiles for national parks.[5] Based on information collected from AMIS staff, about one-fourth of visitors are local day users and three-fourths are nonlocal visitors. Because of the considerable distance between AMIS and population centers other than Del Rio, nearly all of these nonlocal visitors likely stay overnight in the AMIS area. Among nonlocal visitors, the AMIS staff estimated that about 15 percent stay overnight in campgrounds within the park. Using capacity figures and occupancy rates at area motels and campgrounds, NPS estimated that 62 percent of the remaining overnight visitors stay in hotels outside the park and 23 percent stay in campgrounds outside the park. Table 3-3 provides the spending information available for

[5] (see Appendix A and the MGM2 website <http://www.msu.edu/user/stynes/npsmgm/> for more information about economic impact analysis using input-output [I-O] models)

Table 3-3. Generic Spending Profiles for Visitors to National Parks (2001$)[a]

	Spending per Party		
	Low	**Medium**	**High**
Local Day User			
Restaurants and bars	8.64	12.35	16.05
Groceries/take-out	4.33	6.19	8.04
Gas and oil	3.37	4.82	6.27
Other vehicle expenses	0.36	0.52	0.67
Admissions and fees	2.94	4.21	5.47
Clothing	0.69	0.98	1.28
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	4.68	6.68	8.69
Total	**$25.72**	**$36.74**	**$47.76**
Camping Inside the Park			
Camping Fees	11.27	16.09	20.92
Restaurants and bars	7.20	10.29	13.38
Groceries/take-out	9.38	13.40	17.42
Gas and oil	7.42	10.61	13.79
Other vehicle expenses	0.54	0.78	1.01
Local Transportation	0.18	0.26	0.33
Admissions and fees	4.42	6.31	8.20
Clothing	2.06	2.95	3.83
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	4.32	6.17	8.02
Total	**$47.49**	**$67.85**	**$88.20**
Motel Outside the Park			
Motel, hotel cabin or B&B	56.33	80.47	104.61
Restaurants and bars	27.37	39.10	50.83
Groceries/take-out	7.22	10.31	13.40
Gas and oil	6.07	8.68	11.28
Other vehicle expenses	1.09	1.55	2.02
Local Transportation	0.36	0.51	0.67
Admissions and fees	8.83	12.62	16.41
Clothing	4.13	5.89	7.66
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	8.64	12.34	16.04
Total	**$120.73**	**$172.48**	**$224.22**

(continued)

Table 3-3. Generic Spending Profiles for Visitors to National Parks (2001$)[a] (continued)

	Spending per Party		
	Low	**Medium**	**High**
Camping Outside the Park			
Camping fees	15.49	22.13	28.77
Restaurants and bars	8.64	12.35	16.05
Groceries/take-out	6.49	9.28	12.06
Gas and oil	7.42	10.61	13.79
Other vehicle expenses	0.54	0.78	1.01
Local transportation	0.18	0.26	0.33
Admissions and fees	9.57	13.67	17.77
Clothing	4.13	5.89	7.66
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	8.64	12.34	16.04
Total	**$61.81**	**$88.30**	**$114.79**

[a]These values are based on the average expenditures per party for visitors to national parks. However, the number of people per party assumed by MGM2 may differ between visitor segments.

Source: Money Generation Model—Version 2 (MGM2). 2002. <http://www.msu.edu/user/stynes/npsmgm/>. As obtained July 2002.

local visitors on day trips, nonlocal visitors staying in park campgrounds, and nonlocal visitors staying in hotels outside the park to show the range of spending values estimated within this category. Only categories with positive average expenditures for these categories of visitors are included in the table. For this analysis, the medium[6] estimate was used for all of the spending categories analyzed. Because there is no spending category included that represents boat rentals, purchases, service, or storage, it was assumed that the spending estimates from MGM2 are in addition to the directly PWC-related expenditures described above.

To estimate the direct impact on AMIS business revenues, NPS calculated the increase in the number of parties visiting AMIS using data on party sizes and projected changes in visitation from Section

[6]MGM2 provides spending estimates that they classify as low, medium, and high expenditures.

2.[7] NPS then multiplied the increase in the number of parties visiting the AMIS region by their estimated spending in each category for scenarios developed under each alternative. These scenarios are described in detail in Section 3.1. The increase in the number of PWC users to the area will directly increase the revenues of the PWC rental, sales, and service shops as well as the revenues of restaurants and other stores patronized by PWC users.

Table 3-4 provides estimates for each alternative of the direct changes in revenues caused by a change in visitation based on the generic spending profiles for national parks and the information provided by local businesses. It was estimated that revenue would be unchanged relative to baseline under Alternative C. For Alternative B, PWC rental revenue is estimated to increase by $12,050 relative to the baseline estimate, while PWC sales and service revenue is expected to increase by $366,890 relative to the baseline estimate. Under Alternative A, NPS estimated that PWC rental revenue and PWC sales and service revenue would increase by $13,390 and $407,660, respectively, relative to the baseline.[8]

For the other spending categories (those that are included in MGM2), the total change in expenditures was calculated by multiplying the change in number of parties of each type (i.e., local day users and nonlocal day users) by the average expenditure per party for that type of visitor for each expenditure category.

As shown in Table 3-4, the largest direct impact is on establishments offering PWC sales/services, which account for over 90 percent of the estimated revenue increases resulting from allowing PWC to return to AMIS. The increase in PWC sales and service revenue is followed by PWC rentals; motel, hotel cabin, or B&B; restaurants and bars; souvenirs and other retail; groceries/take-

[7]The spending profiles in MGM2 assume 2.5 people per party for local day users and 3.0 people per party for those staying in park campgrounds or hotels outside the park. Thus, NPS scaled the expenditures per party upwards to reflect the larger size of the average party of PWC users (3.67 people). It should also be noted that the number of parties was adjusted to more closely reflect the number of park entries per party for overnight visitors. MGM2 assumes that overnight visitors enter the park more than once (mostly twice) and divides the number of overnight parties by this factor to avoid counting the same party multiple times.

[8]Estimated impacts on PWC rentals, sales, and service are derived from interview data collected from local firms. See Section 5 for additional information.

Table 3-4. First-Year Direct Impact of PWC Reinstatement on Business Revenues in AMIS Region Relative to Baseline (2001$)[a,b]

	Alternative A	Alternative B	Alternative C
PWC rentals and other PWC revenues	$13,390	$12,050	$0
PWC sales/service	$407,660	$366,890	$0
Motel, hotel cabin, or B&B	$6,330	$2,110	$0
Camping fees	$930	$310	$0
Restaurants and bars	$4,860	$1,620	$0
Groceries/take-out	$1,940	$650	$0
Gas and oil	$1,660	$550	$0
Other vehicle expenses	$210	$70	$0
Local transportation	$60	$20	$0
Admissions and fees	$1,920	$640	$0
Clothing	$780	$260	$0
Sporting goods	$230	$80	$0
Souvenirs and other retail	$2,110	$700	$0
Total	$442,080	$385,950	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

out; admissions and fees; gas and oil; camping fees; clothing; sporting goods; other vehicle expenses; and local transportation.

Note that the estimated increases in revenue in Table 3-4 overstate the true direct gains to the region because part of the sales value in the groceries/take-out, gas and oil, clothing, sporting goods, and souvenirs/retail categories goes to individuals and firms outside of the region and thus cannot be considered a gain to the AMIS region. Using these changes in revenues as inputs into MGM2, NPS estimated the total regional impacts on output. As discussed in Appendix A, only the gain of the retail markup in the retail sector can be included as an increase in regional output for the local area. This explains why the direct effect on the region estimated by MGM2 (reported in Table 3-5) is smaller than the change in revenues provided as input.

Table 3-5. First-Year Total Impacts on Value of Output for AMIS Region (2001$)[a,b]

	Alternative A	Alternative B	Alternative C
Direct effect	$201,030	$170,910	$0
Total impact	$280,380	$237,740	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

The impacts of PWC regulation in AMIS on regional output are estimated to be about 0.04 percent of local personal income under the alternative with the most positive impact (Alternative A).

In addition to the direct effect of the regulation on the regional economy, the indirect and induced effects (ripple effects on input suppliers and from changes in household income, respectively) are estimated (see Appendix A). The multipliers used for this analysis are those provided in MGM2 for a typical small metropolitan area. Table 3-5 also summarizes the total impacts on the value of output for businesses in the AMIS region. In this case, the multiplier effects are moderate. The total impact is about 40 percent larger than the direct effect. The total impact estimated for the three alternatives varies from $0 to $280,380 depending on how many people resume visiting the park as a result of reinstating PWC use. The level of personal income in Val Verde County was about $753 million in 2000 (U.S. Bureau of Economic Analysis, 2002), or about $775 million when converted to 2001 dollars. Thus, the impacts of PWC regulation in AMIS on regional output are estimated to be approximately 0.04 percent of local personal income even under the alternative with the most positive impact (Alternative A).

3.2.3 Change in Value Added

Another measure of the impact on the local economy is the change in value added as a result of the regulation. Value added is the amount of dollar value contributed to a product at each stage of its production. It is calculated at each stage by subtracting the costs of intermediate goods from the value of the final good to avoid double-counting the value of intermediate goods. It will be a smaller value than output because it excludes the value of intermediate goods, whereas output measures do not exclude all intermediate goods. The output measure only excludes the cost of goods produced in other regions resold by wholesalers or retailers. To calculate these values for AMIS, the MGM2 data for value added as a share of total output in each sector were applied to the

estimated changes in local output presented in Table 3-5 to get the direct effect on value added by sector. The MGM2 multiplier for value added in each sector was then applied to estimate the total impact. Table 3-6 provides the total change in value added for the local region as a result of the proposed regulations.

Table 3-6. First-Year Total Impacts on Value Added for AMIS Region (2001$)[a,b]

	Alternative A	Alternative B	Alternative C
Direct effect	$99,640	$84,720	$0
Total impact	$198,220	$170,210	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

3.2.4 Effect on Personal Income

Personal income is a portion of value added in which policy makers are commonly interested. It comprises employee compensation and proprietor income. Table 3-7 shows how labor income in the AMIS region changes as a result of the alternatives reinstating PWC use. This value is smaller than value added because it includes only a subset of the components of value added, but it is often useful to break value added down in this way to estimate the effect on regional personal income. Similar to value added, the direct effect of this component is calculated using the MGM2 data for personal income as a share of output in each sector. The total effect is then calculated by multiplying the direct effect by the personal income multiplier included in MGM2 for each sector.

Table 3-7. First-Year Total Impacts on Personal Income for AMIS Region (2001$)[a,b]

	Alternative A	Alternative B	Alternative C
Direct effect	$65,570	$55,750	$0
Total impact	$124,820	$107,160	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

3.2.5 Change in Employment

Another effect of the proposed regulations is to increase employment in the sectors affected by the rules. These changes are calculated by MGM2 based on ratios of sales to employment for the affected industries in the AMIS area. As a result of the increase in sales anticipated under this regulation, companies will need additional employees. The estimated increase in employment ranges from 0 to 6.9 employees, depending on the regulatory alternative. These values are calculated based on MGM2 data on the number of employees per million dollars of output in each industry. Estimated changes in the number of employees are therefore equal to the change in output times the number of employees required per unit of output. Table 3-8 summarizes the results of the employment analysis.

Table 3-8. First-Year Total Change in Employment for AMIS Region (Number of Jobs)[a]

	Alternative A	Alternative B	Alternative C
Direct effect	5.6	4.8	0.0
Total impact	6.9	5.8	0.0

[a]NPS generated these estimates using the MGM2 model (MGM2, 2002).

3.2.6 Change in Tax Revenue

In addition to impacts on the local businesses operating near AMIS, there is also an impact on the state and local governments. There is no state or local income tax in Texas. However, the State of Texas has a 6.25 percent sales tax. In addition, local governments have the option to charge up to 2 percent sales tax in addition to the state tax. Most local administrative units in the area surrounding AMIS charge tax rates near the upper bound of 2 percent. As a conservative estimate of the impacts, NPS assumed all local governments receive funds from a 2 percent local option sales tax. State sales taxes from affected businesses are estimated to increase by between $0 and $27,630 in the three scenarios analyzed, as presented in Table 3-9. Local sales taxes are estimated to increase by $0 to $8,840, depending on the regulatory alternative.

Table 3-9. First-Year Change in State and Local Sales Tax Revenue[a,b]

	Alternative A	Alternative B	Alternative C
State sales tax	$27,630	$24,120	$0
Local sales tax	$8,840	$7,720	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

3.2.7 Summary

Several different measures of the economic impacts resulting from reinstating PWC use in AMIS are presented in this section. Each measure provides slightly different information about the expected economic effects on the region. Income and value added are generally considered the best measures of economic impacts because sales and job estimates can be misleading. Sales or output measures include spending on inputs purchased outside the region, and job estimates are distorted by part-time and seasonal positions because the data available are on jobs, not on full-time equivalents. In addition, the wage rates across different jobs vary widely across industries (Stynes, 2000). Income and value added measures both avoid these difficulties and concentrate on changes that affect only the AMIS region.

NPS estimates that the total impact on regional output is $280,380, $237,740, and $0 for Alternatives A, B, and C, respectively. These gains are very small compared to the size of the regional economy, even under Alternative A, the alternative with the largest impacts.

In the analysis presented here, NPS estimates that the total impact on regional output of the proposed alternatives for regulating PWC use in AMIS is $280,380, $237,740 and $0 for Alternatives A, B, and C, respectively, in the first year after implementation (see Table 3-5). These gains are quite small compared to the size of the regional economy, even under Alternative A (the alternative with the largest impacts). In 2000, total personal income in Val Verde County, where AMIS is located, was approximately $753 million (U.S. Bureau of Economic Analysis, 2002). Thus, even if all revenues related to PWC use in AMIS were to return to the regional economy, the impact would be very small (regional output would increase by approximately 0.04 percent of personal income), although some businesses and communities in the county that rely heavily on PWC users may experience localized impacts.

3.2.8 Uncertainty

A number of factors will affect the regional economic impacts associated with the proposed alternatives. Some of the main sources of uncertainty include the following:

Although NPS has provided its best estimate of the regional economic impacts associated with the proposed alternatives, numerous sources of uncertainty may influence the results.

- The projections of PWC use through 2012 in the absence of a ban were based on NPS estimates of what annual PWC use would have been in 2003 in the absence of a ban (see Section 2.2.4 for uncertainties related to this estimate). This in turn was based on the estimates of AMIS staff of PWC use during 2001. To the extent that PWC users accounted for an unusually small or large proportion of total visitation during this period, projected visitation by PWC users may be understated or overstated.
- The proportion of PWC users who would have continued to visit the park under the ban on PWC use is unknown. As a result, the incremental increase in visitation resulting from reinstating PWC use may be higher or lower than calculated in this analysis.
- Non-PWC users may have increased visitation following the ban. To the extent that they would reduce their visitation relative to the baseline if PWC use were reinstated, the positive impacts to local businesses of reinstating PWC use would be partially offset. Because insufficient information regarding this effect was available, this potential impact was not quantified in the analysis, which will tend to overstate the regional impacts.
- EPA regulations phasing in emissions reductions from new PWC over the period from 1996 to 2006 (See Section 2.2.4) are expected to increase the cost of producing PWC over time. The corresponding increase in market price of PWC may lead to a reduction in sales that would reduce PWC use in AMIS in the absence of the ban relative to the projected levels. This would tend to reduce the incremental benefits attributable to NPS regulations reinstating PWC use in future years. However, cost increases due to these regulations are probably captured in the current PWC use figures to some degree because the rule has already required some reduction in emissions.
- Generic spending patterns and multipliers from MGM2 were used to represent economic activity in the AMIS area. To the extent that spending patterns of PWC users in AMIS differ from the generic spending of local and nonlocal day users and/or the generic multipliers for a national park in a small metropolitan area differ from the multipliers for the AMIS region, the impacts may be understated or overstated.
- In addition, the general uncertainties and caveats are associated with the use of I-O models. These factors are described in further detail in Appendix A.

4 Benefit-Cost Analysis of the Alternative Regulations

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. The impacts of this action, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals.

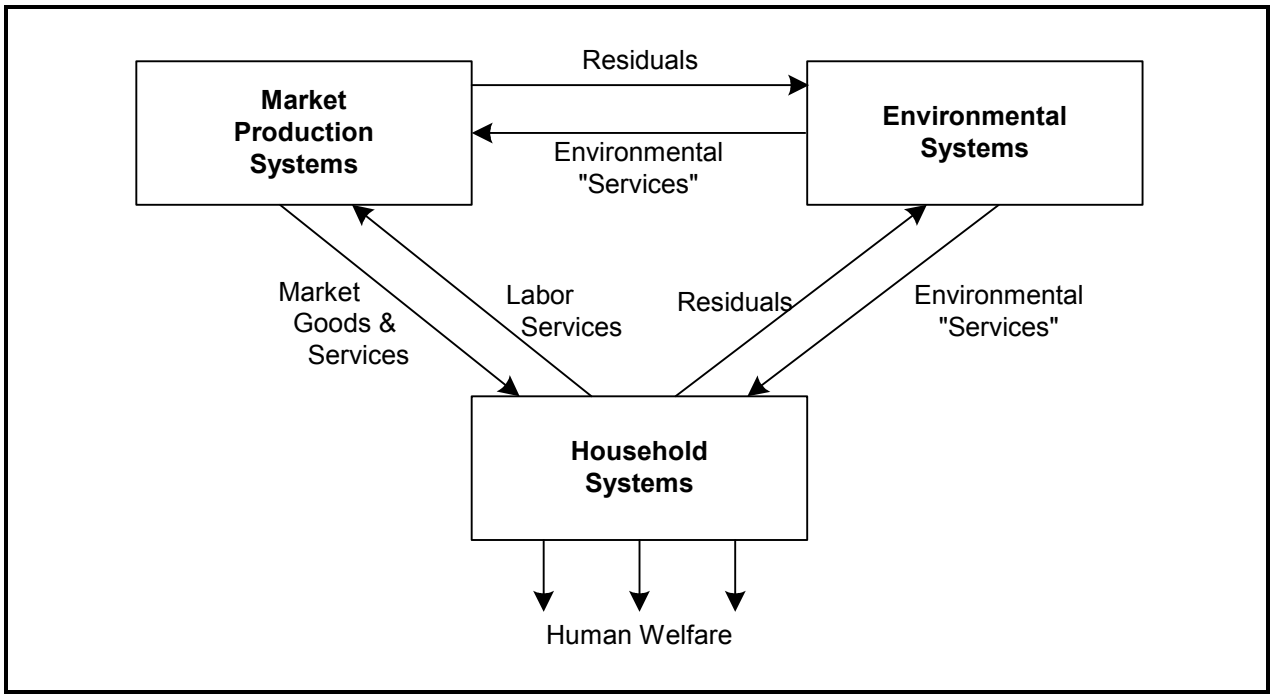
The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. It examines whether the reallocation of society's resources resulting from the action promotes efficiency. That is, it assesses whether the action results in benefits (gains in social welfare) greater than the associated costs to society (losses in social welfare).

Section 4.1 provides a general outline of the approach to benefit-cost analysis and the possible benefits and costs of PWC regulations in national parks. Section 4.2 presents the analysis for AMIS specifically.

4.1 CONCEPTUAL BASIS FOR BENEFIT-COST ANALYSIS OF PWC RESTRICTIONS IN NATIONAL PARKS

According to the conceptual underpinnings of benefit-cost analysis, all social welfare impacts ultimately accrue to individuals. This is represented in Figure 4-1, which depicts flows of goods, services, and residuals among three major systems: market production, household, and the environment. Because these systems are closely interconnected, actions taken to reduce releases of harmful residuals (e.g., chemicals or noise pollution) to the environment will potentially reverberate throughout all of these systems.

Figure 4-1. Interrelationship Among Market, Environmental, and Household Systems and Social Welfare



Nevertheless, the impacts of these actions, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals. As a result, identifying and measuring benefits and costs must focus on these changes in well-being.

The conceptual framework depicted in Figure 4-1 therefore provides a basis for assessing the benefits and costs of PWC regulations in national parks. In these cases, the most direct impact will be on households that use PWC, whose recreational opportunities will be affected by the regulations. This will result in direct changes in welfare for these households. In addition, the resulting changes in the behavior of these households are likely to affect environmental systems and market systems. Effects on these systems will indirectly affect the welfare of other households. For example, the park environment will be improved or degraded, and this change will affect the "services" (primarily recreation-related) that the park provides to other households and individuals in society. Businesses that cater to non-PWC visitors may also be affected if the number of people visiting the park changes. On the other hand, the resulting changes in the market demand for PWC-related goods and services

will have impacts for those who own or work for establishments supplying these services.

These types of direct and indirect impacts are identified and evaluated as part of this benefit-cost analysis. Specifically, in Section 4.2 NPS estimates the incremental benefits and costs relative to the baseline.

In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. In other instances, welfare changes are not directly associated with pecuniary gains or losses.

Estimating the value of benefits and costs also requires methods for expressing welfare changes in monetary terms. In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. For example, welfare gains or losses to PWC sales shops due to changes in demand for their services can be reasonably measured as their resulting net change in income. In other instances, welfare changes are not directly associated with pecuniary gains or losses. Such "nonmarket" changes might, for example, include the welfare gains or losses from improved or degraded recreational opportunities in a park. In these cases a surrogate measure of gains or losses must be used; willingness to pay (WTP) is such a surrogate. Economists and other practitioners of benefit-cost analysis generally accept WTP as the conceptually correct measure for valuing changes in individuals' welfare. WTP represents the maximum amount of money that an individual would be willing to forgo to acquire a specified change. As such, it is the monetary equivalent of the welfare gain from the change.

Using this conceptual framework for identifying, measuring, and valuing changes in societal welfare, the remainder of this section and Appendix B provide a more detailed discussion of

- ➤ the types of benefits and costs associated with PWC restrictions in national parks and
- ➤ the approaches used in measuring these benefits and costs.

4.1.1 Social Costs of PWC Use

Use of PWC in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. The extent to which adverse impacts will be realized is a function of several factors, including the level of use, the technology of the machines being used, and the extent to which users remain in designated areas. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks'

environmental systems. The negative impacts of PWC use on other people are also referred to as negative externalities. If PWC do generate negative externalities, then this represents a market failure. The private cost of using a PWC (the cost to the individual PWC user) will be lower than the social cost of PWC use (where the social cost of PWC use includes both the cost to the PWC user plus the costs to others that result from the negative externalities associated with PWC use). Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be maintained at a higher level than socially optimal in the absence of regulation.

Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be maintained at a higher level than socially optimal in the absence of regulation.

The costs of allowing PWC in national parks can therefore be thought of and measured as the increase in these incremental losses to society. In addition, use of PWC can negatively affect society in ways that are not directly related to the environment; therefore, the incremental costs of PWC regulations must also include increases in these nonenvironmental losses.

Table 4-1 provides a broad classification of the types of environmental and nonenvironmental impacts associated with PWC use in national parks. In this section, this classification is used to more completely identify, categorize, and describe the full range of potential benefits associated with PWC restrictions in national parks in general. In Section 4.2.3, this framework is then used to specifically describe the costs that are expected to result from the management alternatives for AMIS.

Table 4-1. Classification of Potential Negative Impacts from PWC Use in National Parks

Impact Categories	Examples of Impacts
Environmental impacts	
Aesthetic	Noise, visibility, odor
Human health	Through impacts to air and water quality
Ecosystems	Loss of or damage to habitat and wildlife
Nonenvironmental impacts	
Infrastructure	Costs of monitoring, maintenance, and law enforcement
Human safety	Accidents
Cultural, historical, and archeological	Physical damages

The value that people place on a particular recreational activity depends strongly on the availability of substitutes. In areas where numerous areas are available for recreational activities, the value of improving environmental conditions in one of those areas will tend to be smaller.

Environmental Costs of PWC Use

The use of PWC may have adverse impacts on air quality, natural resources (e.g., water quality, habitat), wildlife, and natural quiet. Figure 4-2 depicts the various categories of potential adverse effects to the environment through which PWC use in national parks can impose welfare losses on society.

- ➤ Typical (two-stroke engines) PWC release substantial amounts of noise and pollutants into the environment. Noise from PWC impairs the natural soundscape for park visitors and has the potential to negatively affect wildlife in the park. Emissions from PWC can also negatively affect park ecosystems, human health, and visitor experiences. The three primary reasons for the potential impacts due to release of pollutants are as follows:
  - ✓ up to one-third of the fuel delivered to the engine is expelled without being burned,
  - ✓ lubricating oil is mixed with fuel and thus is expelled as part of the exhaust, and
  - ✓ the combustion process results in high emissions of air and water pollutants.

Pollutants are directly released to air and water, causing contamination of air and water resources.

As shown in Figure 4-2, all of these impacts can, directly or indirectly, lead to losses in human welfare. Therefore, from a benefit-cost perspective, those who ultimately lose from actions to allow PWC will be individuals who value the quality of the park environment. Many of those that experience losses will be park visitors whose recreational experiences are disturbed. As a point of reference, Table 4-2 reports average consumer surplus values that have been estimated for common non-PWC-related summer recreation activities from a study by Rosenberger and Loomis (2000). These are the types of recreation values that may be diminished by the presence of PWC.

The value that people place on a particular recreational activity depends strongly on the availability of substitutes. In regions where numerous areas are available for recreational activities, the value of changing environmental conditions in one of those areas will tend to be smaller. The reason is that there are already many other areas where people can engage in the same activity. Unless there are unique characteristics that people value in the area where

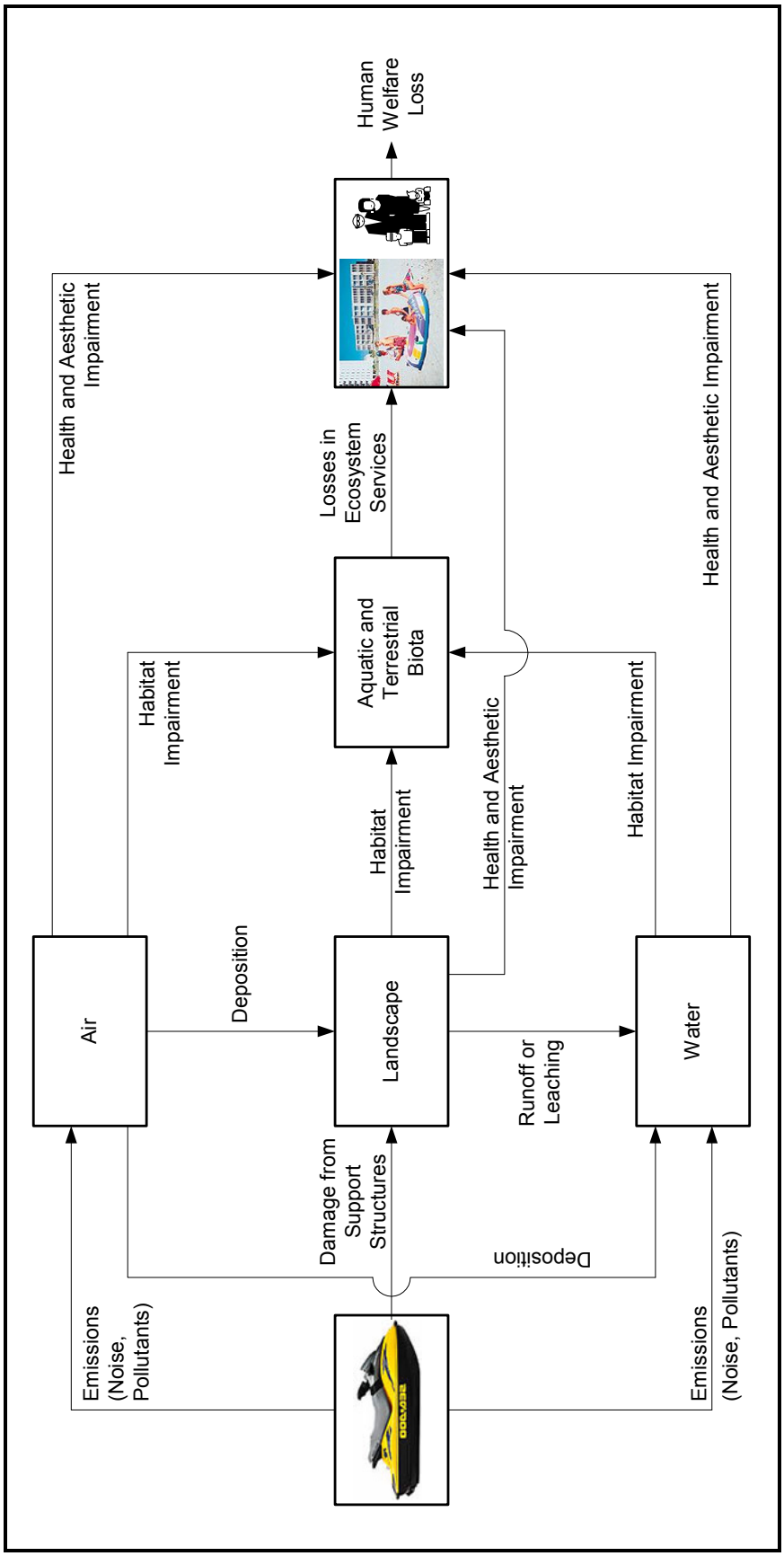


Figure 4-2. Routes of Environmental Damages and Human Welfare Losses from PWC Use in National Parks

Table 4-2. Summary of Average Recreation Values (2001$ per Person per Day) for Selected Activities by Region[a,b]

Activity	Study Location					U.S. Average
	Northeast	Southeast	Mountain	Pacific	National[c]	
Picnicking	59.46 (1)	40.10 (1)	39.10 (7)	79.62 (2)	16.89 (1)	45.78 (12)
Swimming	40.06 (5)	NA	NA	16.10 (1)	22.26 (1)	34.10 (7)
Hiking/backpacking	48.46 (2)	118.40 (2)	40.29 (3)	21.95 (6)	22.47 (1)	43.48 (14)
Fishing	34.06 (42)	29.87 (13)	45.75 (39)	39.96 (16)	40.12 (4)	38.62 (114)
Motor boating	56.46 (2)	NA	74.04 (2)	16.29 (1)	41.67 (1)	53.16 (6)

NA = Not available.

[a]All amounts were inflated using the consumer price index for recreation available from the U.S. Bureau of Labor Statistics (2002). Numbers in parentheses represent the number of observations (i.e., studies).

[b]These values were taken from multiple studies conducted between 1967 and 1998.

[c]Studies estimating nationwide values.

Source: Rosenberger, Randall, and John Loomis. 2000. "Using Meta-Analysis for Benefit Transfer: In-Sample Convergent Validity Tests of an Outdoor Recreation Database." *Water Resources Research* 36(4):1097-1107.

conditions will be improved or degraded, there will probably be relatively small benefits or costs as a result of the environmental change. On the other hand, in regions with few substitutes for the local national park that would potentially experience environmental damage as a result of the regulations, the losses to park users may be much greater.

Even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. In other words, they may hold positive or negative "nonuse values" (i.e., a positive WTP) for protecting or degrading the park environment. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Pearce and Moran [1994] review studies that have attempted to estimate nonuse values for the protection of unique species and ecosystems. The measurement of nonuse value remains controversial, and in this report NPS does not attempt to quantify the possible benefits or costs associated with nonuse values. Allowing PWC use in national parks can therefore result in losses to

both users and nonusers in a number of ways by degrading the parks' ecological resources.

Appendix B provides a more detailed discussion of the nonenvironmental impacts, in particular, and how these restrictions can affect public safety in national parks and reduce the costs of operating and maintaining the infrastructure necessary to support and monitor PWC use.

4.1.2 Social Benefits of PWC Use

The primary benefits associated with allowing the use of PWC in national parks will accrue to

- PWC users, especially individuals who would otherwise not use PWC in the park as a direct result of the ban on PWC use, and
- providers of PWC-related services for park visitors.

Just as Section 4.1.1 described potential consumer surplus losses to other park visitors and the public associated with PWC use, the potential welfare gains to PWC users are measured in terms of consumer surplus. Regulations that restrict the use of PWC impose costs on PWC users. For instance, prohibiting PWC use in the park has resulted in a loss of the consumer surplus for former AMIS PWC users. Reinstating PWC use in AMIS under Alternative B, which imposes restrictions such as limiting the areas of the park that are open to PWC, would increase the consumer surplus of PWC users relative to baseline. A return to pre-ban PWC management practices under Alternative A, with fewer restrictions on travel in certain sensitive areas and additional safety measures, would increase the consumer surplus of PWC users slightly more than under Alternative B.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and other experts, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip.

As with other activities, the extent of the welfare loss to an individual rider depends crucially on the availability of substitute areas to use PWC and/or to engage in other recreational activities. All else equal, individuals who have fewer substitutes for PWC use (either other places to use PWC or other activities they enjoy as much) enjoy greater consumer surplus from PWC use in a particular body of water and thus will experience a greater gain in welfare if that body of water is opened to PWC use.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in

recreation demand analysis at universities, and other experts, NPS was unable to locate a study that estimated the consumer surplus associated with a PWC trip. Table 4-2 presents the results of a review of the recreation literature conducted by Rosenberger and Loomis (2000). The review found an average value of $49.37 (1996 dollars) per person per day for riding in motor boats (with estimates ranging from $15 to over $65). The same study reports a value of $26.79 (1996 dollars) per person per day (with estimates ranging from $20 to over $30) for off-road driving. Bhat et al. (1998) report consumer surplus estimates ranging from $9.12 to $54.93 for motorboating and waterskiing in different regions of the country. These estimates, along with the estimates in Table 4-2, provide a range of values for activities similar to riding PWC and provide a bound on the consumer surplus for PWC users expected from the regulations. Note that measures of net consumer surplus to PWC riders that do not account for the additional costs imposed on society by the negative externalities associated with PWC use will overstate the true net social welfare associated with the activity.

Even PWC users who do not currently visit the park may have a positive value associated with maintaining access for PWC in parks that they could potentially decide to visit in the future. These users hold an option to visit the park in the future. Restrictions on PWC access to parks would reduce or eliminate the value of that option. Thus, PWC users who do not visit the park may still experience a gain in welfare if the park allows PWC use. However, because information was lacking on the population of PWC users who may choose to visit a given park in the future and the value that they place on that option, NPS does not attempt to quantify the potential gains in option value.

An increase in PWC use at a particular park may also affect businesses that offer services to PWC users. These businesses are not directly affected by NPS regulations of PWC users (i.e., none of the regulations directly require any action from PWC dealerships, rental shops, or other businesses), but they are likely to be affected nonetheless. For example, allowing PWC use in national parks may lead to increased demand for PWC sales or rentals and decreased demand for motorboats or canoes. These shifts in demand may reallocate sales among businesses and may lead to an increase in total revenue for businesses providing tourism-related services. As

described in Section 3, the local economy may also experience ripple effects. If businesses that serve PWC users experience an increase in demand for their services, they will most likely increase their purchases of inputs from other sectors of the local economy, including labor. In addition, an increase in revenue for local firms tends to increase regional income. Increases in average household income for the region surrounding the park will also lead to increases in sales for local businesses as local households respond by purchasing more goods (see Appendix A for more detailed information on ripple effects).

Whether these indirect, or secondary, impacts should be included as a change in social welfare in the benefit-cost analysis depends on whether the change in demand or supply in the secondary market results in prices changes (for details, see a benefit-cost analysis textbook such as Boardman et al. [1996]). In general, when the policy change in the primary market (PWC trips to the national park) causes prices to change in the secondary markets, the net change in social welfare from the secondary market should be included in the benefit-cost analysis. If prices do not change in the secondary market, the revenue gains or losses should not be included in the benefit-cost analysis. If the people who would have used PWC in the national park spend their money elsewhere instead, this represents a transfer from one region of the country to another or from one business to another. Although the loss in revenue may hurt the businesses located near the national park, from society's point of view this represents a transfer of income rather than a true cost to society as a whole.

Without more detailed information, it is difficult to predict with certainty whether the proposed alternatives will affect prices for PWC sales or rentals. However, NPS believes it is quite possible that the changes in demand that would occur under these alternatives may result in price changes for PWC-related markets. Thus, losses or gains to tourism-related businesses that may be indirectly affected by the rule are included in the benefit-cost analysis.

4.2 RESULTS FOR AMISTAD NATIONAL RECREATION AREA

Based on the approach and possible impacts outlined above, this section presents the results of the benefit-cost analysis for AMIS.

The section discusses the groups most directly affected by the alternatives for managing PWC use in the park and several scenarios for the possible levels of impacts. The benefits and costs accruing to these groups, relative to the baseline (where PWC are banned from AMIS) are then presented.

4.2.1 Affected Groups

For the purpose of this study, six major affected groups, listed in Table 4-3, have been identified:

1. PWC users, in particular those who used PWC in AMIS prior to the November 2002 ban and those who may wish to use PWC in AMIS in the future.
2. Other visitors or potential visitors who may have a different experience at the park if PWC use is reinstated in AMIS (canoeists, anglers, swimmers, hikers, boaters, and other visitors).
3. Producers of PWC services (e.g., PWC rental shops, PWC sales shops, restaurants, gas stations, hotels) in the area surrounding AMIS who may experience a change in their welfare if PWC use in the park changes.
4. Local residents of the area surrounding AMIS.
5. Producers of services to other types of summer visitors (e.g., canoe rentals or powerboat rentals) who may experience a change in their welfare related to the number of PWC users in the park.
6. The general public who may care about the natural resources in AMIS even if they do not visit the park.

The impacts on these groups under each alternative are discussed in more detail below.

Alternative A, which reinstates PWC use as managed prior to the ban, has a negative effect on all user groups except for PWC users and the businesses that cater to them. PWC users, PWC dealerships, and other businesses that provide services to PWC users are expected to experience gains of consumer and producer surplus. Adverse impacts of PWC on anglers, swimmers, canoeists, and other users within AMIS relative to the baseline increase somewhat under this alternative because PWC would be allowed within the park's boundaries. The impact on boaters is ambiguous. Allowing PWC in the park should have negative impacts on other boaters' consumer surplus because of the increased probability of accidents between boaters and PWC users and increased noise levels. However, there is some overlap between people that use

Table 4-3. Impact of Alternatives on User Groups

User Group	Alternative A	Alternative B	Alternative C: No-Action
1. PWC users	• Consumer surplus is expected to increase as a result of lifting the ban on PWC in AMIS.	• Consumer surplus is expected to increase, although somewhat less than for Alternative A because of the additional restrictions on travel in certain sensitive areas and additional safety measures.	• No change in consumer surplus.
2. Other visitors or potential visitors: canoe users, anglers, other boaters, swimmers, hikers and other visitors	• Consumer surplus for current users of AMIS is expected to decrease as a result of decreased solitude, increased noise, decreased water quality, and an increase in the risk of accidents involving PWC. • Consumer surplus is expected to decrease for potential visitors who would have visited AMIS with a ban on PWC use.	• Consumer surplus for current users of AMIS is expected to decrease as a result of decreased solitude, increased noise, decreased water quality, and an increase in the risk of accidents involving PWC. • Consumer surplus is expected to decrease for potential visitors who would have visited AMIS with a ban on PWC use.	• No change in consumer surplus.
3. Producers of PWC services: PWC rental shops, PWC sales shops, and other parts of the local economy providing services to PWC users	• AMIS marina concessions are expected to experience an increase in producer surplus from gas sales and, to a lesser degree, PWC rentals, especially if those who use PWC in conjunction with larger boats no longer visit. • Producer surplus for the area's PWC dealerships is expected to increase. • Other parts of the local economy such as hotels, restaurants, and gas stations located near AMIS may have an increase in producer surplus.	• PWC rental shops and sales shops are expected to experience a small increase in producer surplus. • Other parts of the local economy such as hotels, restaurants, and gas stations located near AMIS may have an increase in producer surplus.	• No change in consumer surplus.

(continued)

Table 4-3. Impact of Alternatives on User Groups (continued)

User Group	Alternative A	Alternative B	Alternative C: No-Action
4. Local residents of the area surrounding AMIS	• Local residents who use PWC will experience an increase in welfare as a result of reinstating PWC in AMIS. • Local residents who do not use PWC may experience a decline in welfare as a result of an increase in noise, a decline in water quality, and an increase in the risk of accidents involving PWC.	• Local residents who use PWC will experience an increase in welfare as a result of reinstating PWC in AMIS, although not as much as under Alternative A because of restrictions on travel in certain sensitive areas and additional safety measures. • Local residents who do not use PWC may experience a decline in welfare as a result of an increase in noise, a decline in water quality, and an increase in the risk of accidents involving PWC.	• No change in welfare.
5. Producers of services for visitors to AMIS who do not use PWC	• Producer surplus is expected to decrease slightly because allowing PWC may result in a decrease in demand for other activities in AMIS, resulting in decreased demand for the provision of services related to these activities.	• Producer surplus is expected to decrease slightly because allowing PWC may result in a decrease in demand for other activities in AMIS, resulting in decreased demand for the provision of services related to these activities.	• No change in producer surplus.
6. The general public who may care about the natural resources in AMIS even if they do not visit	• May experience a decrease in welfare as a result of diminished nonuse values resulting from decreased environmental quality.	• May experience a decrease in welfare as a result of diminished nonuse values resulting from decreased environmental quality, although the change in welfare is expected to be smaller than under Alternative A.	• No change in welfare.

PWC and those that use other types of boats. Users of houseboats, powerboats, and other non-PWC boats may enjoy using PWC as part of their boating trips and may experience welfare gains as a result of lifting the ban.

Alternative B is expected to have a very similar effect on all park user groups as Alternative A with the exception of some PWC users who may consider the restrictions on travel in certain sensitive areas and additional safety measures to be a negative impact. NPS estimates that the restriction proposed under Alternative B will slightly reduce PWC sales, rentals, and other PWC-related business revenues relative to Alternative A.

Alternative C, which maintains the ban on PWC, would have no effect on any user group relative to baseline conditions.

4.2.2 Scenarios

NPS considers the baseline conditions to which the alternatives are compared to be a ban on PWC use in AMIS.

To develop estimates of the benefits and costs of the rule under each alternative, NPS used the scenarios described below. NPS considers the no-action alternative to be the baseline to which the alternatives are compared. It should be noted that under the baseline projections, park-related PWC rentals are assumed to have declined by 100 percent relative to the pre-ban levels. NPS assumed that the AMIS concession marinas lost 100 percent of revenue from PWC rentals and gas for PWC. PWC sales and storage facilities are assumed to have also lost 100 percent of their PWC-related income, and other businesses serving PWC users were expected to lose 100 percent of PWC-related revenues relative to pre-ban conditions. In the baseline, it is assumed that 15 percent of PWC users who used PWC in AMIS prior to the ban no longer visit AMIS for other recreational activities.

Alternative A

This alternative reinstates PWC use in AMIS as previously managed prior to the ban. Based on interview data, NPS assumes that PWC rental shops in the region will regain 100 percent of pre-ban PWC rental revenues related to AMIS. In addition, NPS assumes that PWC sales and service shops in the region will regain their pre-ban park-related revenues.

Alternative B

The second alternative reinstates PWC use in AMIS with additional restrictions falling into two general categories: restrictions on travel in certain sensitive areas and additional safety measures. Under this alternative, NPS assumes that the region will regain 90 percent of pre-ban PWC sales, service, and rentals related to the park relative to baseline conditions based on interviews with local businesses. It is also assumed that other local businesses serving PWC users will regain 90 percent of PWC-related revenues relative to pre-ban conditions as a result of the increase in visitation predicted to accompany this restriction.

Alternative C (No-Action)

This alternative would maintain the ban on PWC from AMIS. Under this alternative, NPS assumes there will be no impacts on revenues for businesses providing services to PWC users.

4.2.3 Costs

As described in Section 2.5, Section 4.1, and Appendix B, PWC use in national parks can be linked to a wide variety of negative impacts. Allowing their use in these parks can therefore harm society in a number of ways. Section 2.5 specifically describes the impacts on natural resources that may result from PWC use within the boundaries of AMIS. This section describes how the regulatory alternatives identified above will affect these impacts and assesses the costs of these regulations. Assessing these costs in strictly quantitative (i.e., monetary) terms is not feasible with currently available data; therefore, the costs are largely described in qualitative terms.

Those bearing the largest share of the costs as a result of implementing Alternative A or B would be AMIS visitors who do not use PWC and whose park experience is negatively affected by the presence of PWC in the park. Alternative C is not expected to result in any incremental costs to park users because it continues baseline use patterns. Average annual visitation to AMIS was just over 1.1 million people from 1997 to 2001. Most of these visitors are believed to come to the park for some form of water-based recreation, but according to NPS estimates, non-PWC users accounted for over 99 percent of total visitation (see Section 2.2).

"Nonusers" of the park are also likely to bear the costs as a result of PWC regulations in AMIS (see Section 4.1 and Appendix B for more details). For example, individuals who do not visit the parks can experience a decline in welfare simply from the knowledge that the natural resources of the park may be degraded by PWC use. Part of this loss may stem from a decreased assurance that the quality of the park's resources is being protected for the enjoyment of future generations. Therefore, some of the cost categories described below, in particular those associated with the degradation of unique park resources and ecosystems, may accrue in the form of nonuse values.[1]

Aesthetic Costs—Noise and Visibility Impacts

Alternatives that reinstate PWC use will increase noise levels in AMIS and reduce the level of natural quiet along portions of the shoreline. They also have the potential to degrade visibility by leading to an increase in the amount of ozone-causing emissions. However, because a large number of motorized boats already operate along the shore in the baseline, and air quality and noise standards were being met prior to the PWC ban, the incremental negative impacts of allowing PWC in the park are likely to be relatively small.

Alternative A: This alternative will have the greatest impact relative to the ban because it will allow PWC in all pre-ban areas of AMIS. However, noise from other boating activities is prevalent in the baseline. Thus, the incremental impact due to PWC use in the park is relatively small. It is expected that, with improved technology, quieter PWC will become the standard, and sounds generated by PWC will decrease over time.

[1] The importance of recognizing these values is affirmed in the Organic Act. It established the fundamental purpose of the national park system, which includes providing for the enjoyment of park resources and values by the people of the United States. The mandate applies not just to the people who visit parks—but to all people—including those who derive inspiration and knowledge from afar. Furthermore, through the Redwood Act of March 27, 1978, Congress has provided that when there is a conflict between conserving national park resources and values and providing for enjoyment of them, conservation is to be the primary concern.

Alternative B: This alternative will have much the same impact as Alternative A, because it only bans the use of PWC upstream from Lake Amistad on the Rio Grande and the Pecos River and within 100 feet of identified least tern nesting grounds.

Alternative C (No-Action Alternative): This alternative continues baseline management and offers no change in soundscape or visibility relative to baseline conditions.

Allowing PWC use under Alternative A or B will impose costs to recreators in the park, such as canoeists, anglers, birdwatchers, and hikers, relative to baseline conditions. Noise emissions have been identified as a particular nuisance to nonmotorized recreators, such as canoeists and hikers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Anglers using motorized boats also value the natural soundscape. Therefore, increasing noise from PWC activity in the parks will degrade the experience for both motorized and nonmotorized recreators.

In addition to generating high noise levels, PWC also emit strong-smelling fumes that can be bothersome to other recreators and reduce visibility. These effects tend to be much more localized than noise emissions. Finally, NPS assumes that visibility impacts from emission increases resulting from allowing PWC under these alternatives will be negligible.

Human Health Costs

PWC emissions contain relatively high levels of pollutants such as VOC, CO, PM, NO_X, and HCs, which are potentially damaging to human health. It is very unlikely that historic PWC use in AMIS represented a significant health threat to humans; nevertheless, the potential for adverse health effects exists. For example, some of the toxic HCs are potentially harmful even at very low levels of exposure (EPA, 2000a; EPA, 1999a). The continued use of other motorized watercraft in AMIS means that, even if PWC remain banned, there would only be a small decrease in emissions levels. In summary, the human health costs related to both air and water quality impacts of the regulations are expected to be negligible for all of the alternatives.

Ecosystem Degradation Costs

As discussed in Sections 2 and 4.1 of this report, PWC use has the potential to negatively affect ecosystems and natural habitats in a variety of ways. In the case of national parks, these natural resources are of particular value to the public. Although PWC use in AMIS is not expected to cause widespread ecosystem damages, allowing PWC in the park can nonetheless cause damage to the welfare of visitors and nonusers by degrading some of the park's natural resources.

Alternative A: This alternative would have negligible impacts on water quality and AMIS ecosystems because PWC are allowed in the park as previously managed without additional geographic or no-wake restrictions. However, as discussed in Section 2, allowing PWC under Alternative A is not likely to result in damages to AMIS ecosystems, particularly because the impacts of PWC to water quality prior to the ban were estimated as minor in most areas of the park.

Alternative B: This alternative would have some negligible negative impacts on water quality. These effects are likely to be slightly smaller than under Alternative A.

Alternative C (No-Action Alternative): This alternative would have no impact on water quality and natural resources relative to baseline conditions.

As discussed in Section 2.5 of this report, PWC use has the potential to negatively affect fish and wildlife in a variety of ways. In addition to being a potential nuisance to other recreators, noise from PWC may disturb wildlife. Localized, short-term negligible effects on wildlife could occur under Alternative A or B, by increasing noise disturbance and the chance for collisions with wildlife.

Although the impacts of reinstating PWC are expected to be limited, potential harm to the park's ecosystems could degrade the experience of park visitors slightly, for example, by decreasing their chances of viewing wildlife in a natural environment. It could also result in welfare losses to individuals across the country who value the park's unique ecosystems and natural habitats, regardless of whether they actually visit the park. That is, any degradation of the park's ecosystems can result in nonuse costs to society.

Safety and Congestion Costs

In addition to environmental costs associated with increases in PWC use, there also may be safety and congestion costs. Since 1990, injuries associated with the recreational use of PWC have increased at least four-fold. The number of injuries reported from PWC use is now higher than that reported from motorboat use in the U.S. (Branche, Conn, and Annest, 1997). Because of the disproportionately large number of injuries associated with PWC use, allowing their use may decrease the safety of park visitors. In addition, the level of congestion is an important factor determining visitor enjoyment. Increases in congestion related to PWC use may therefore have costs to other park users.

Alternative A: This alternative has the potential to increase PWC-related accidents in AMIS relative to baseline conditions (where there are none because PWC are banned). However, because congestion might decrease in non-NPS waters it is possible that accidents involving PWC could decrease overall because PWC use is distributed over a larger area when AMIS becomes available for use.

Alternative B: Like Alternative A, this alternative has the potential to increase safety risks and congestion in AMIS, but because PWC use may decrease in non-NPS waters as PWC users switch back to AMIS, the overall effect on safety and congestion is unknown.

Alternative C (No-Action Alternative): This alternative would have no effect on safety and congestion in AMIS relative to the baseline ban.

Any increase in PWC-related accidents will also increase the costs to NPS associated with medical/rescue operations, relative to baseline conditions.

4.2.4 Benefits

PWC users, as well as some businesses in the local area, may experience welfare gains as a result of the proposed alternative regulations.

Benefits to PWC Users

For PWC users who currently ride in AMIS or who want to ride in the park in the future, reinstating PWC use in the park could result in consumer surplus gains.

Two main groups of PWC users may be affected by the regulations: those who used PWC in AMIS and those who use PWC in substitute areas outside AMIS where PWC users displaced from AMIS ride because of the ban in AMIS.

PWC users who currently ride in areas where displaced riders from AMIS may have visited will gain some consumer surplus if these areas are less crowded than under baseline conditions because of reinstating PWC use in AMIS. Although no studies were available that examined the impact of congestion on the value of a PWC trip, other recreation demand studies find that congestion lowers the value of a recreation experience (see Appendix B). For PWC users who rode in AMIS or who want to ride in the park in the future, allowing PWC use in the park could result in consumer surplus gains. To the extent that individuals consider other PWC areas close substitutes, the change in consumer surplus associated with allowing PWC use in the park will be lower.

If each individual's demand curve for riding a PWC in AMIS were known, then NPS could add up the gains of consumer surplus for each individual to find the total change in consumer surplus to PWC riders from the proposed management alternatives. Because the demand curve reflects the individual's preferences for available substitute activities and the cost of these activities, measuring the change in consumer surplus from a trip in the park takes into account substitute activities. In this case, NPS does not know the consumer surplus associated with PWC use in AMIS, nor does NPS know the riders' next best alternative activities.

To assess the incremental change in consumer surplus for PWC users, NPS used the benefit transfer technique.

To assess the incremental change in consumer surplus for PWC users, NPS used the benefit transfer technique. After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and experts at consulting firms, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip. A review of the recreation literature conducted by Rosenberger and Loomis (2000) found an average value of $31.98 (1996 dollars) per person, per day for riding in motor boats in the entire United States (with estimates ranging from $15 to over $50). Bhat et al. (1998) estimate an average consumer surplus of $28.56 (1998 dollars)

associated with motorboating and waterskiing in an area that includes parts of the western edge of Texas (along with California, Arizona, and New Mexico). Converted to 2001 dollars, the average consumer surplus reported in this study is $31.03. The estimate comes from a travel cost model based on data from the Public Area Recreation Visitors Study (PARVS). The PARVS data were a multiagency survey that included on-site interviews of recreationists at over 350 sites across the U.S. between 1985 and 1992. For the benefit transfer, NPS used the value from Bhat et al. (1998) based on the following criteria:

- Waterskiing and motorboating are similar activities to PWC use.
- The region where the data were collected includes the western part of Texas, where the study site is located.
- Bhat et al. (1998) was published in a peer-reviewed journal. The authors estimate a travel cost model using data from on-site interviews and only estimate values for activities in a particular region for which at least 100 observations were collected.

Below NPS discusses the estimated impact of each proposed alternative on PWC users.

Alternative A: This alternative would reinstate PWC use in AMIS as previously managed. All visitors using PWC in AMIS prior to the ban are assumed to regain the full value of their consumer surplus for PWC use in AMIS.

Alternative B: This alternative, much like Alternative A, would allow PWC use in AMIS but would maintain a ban on PWC use upstream from Lake Amistad on the Rio Grande and the Pecos River and within 100 feet of identified least tern nesting grounds. These restrictions may cause PWC users that frequent this area to regain only a portion of their consumer surplus. NPS expects the differences between consumer surplus gains under this alternative and Alternative A to be minor.

Alternative C (No-Action Alternative): The no-action alternative would maintain the current ban on PWC use in AMIS. This would not change regulations relative to baseline conditions and, consequently, would not have any incremental impact on the consumer surplus of any user group.

Using the value of $31.03 for a day of PWC use, NPS provides estimates of possible incremental gains in consumer surplus to PWC users as a result of Alternatives A and B. For Alternative C, NPS assumes there would be no change in visitation to AMIS by PWC users and no measurable change in consumer surplus. Table 4-4 summarizes the projected consumer surplus gains for PWC users in AMIS for Alternatives A and B and the no-action alternative from 2003 to 2012 and the present value (PV) of these gains using both 3 percent and 7 percent discount rates. PV is the value of a future stream of benefits or costs, discounted to current years. Depending on the discount rate and scenario, the present value of consumer surplus gains for PWC users in AMIS from Alternatives A and B from

Table 4-4. Projected Incremental Change in Consumer Surplus for PWC Users under Alternatives A and B, 2003–2012 (2001$)[a]

	Alternative A		Alternative B	
Year	Change in Number of People Using PWC	Change in Consumer Surplus ($)	Change in Number of People Using PWC	Change in Consumer Surplus ($)
2003	6,699	$ 207,850	6,029	$ 187,060
2004	6,799	$ 210,970	6,119	$ 189,870
2005	6,901	$ 214,130	6,211	$ 192,720
2006	7,005	$ 217,340	6,304	$ 195,610
2007	7,110	$ 220,600	6,399	$ 198,540
2008	7,216	$ 223,910	6,495	$ 201,520
2009	7,325	$ 227,270	6,592	$ 204,540
2010	7,434	$ 230,680	6,691	$ 207,610
2011	7,546	$ 234,140	6,791	$ 210,730
2012	7,659	$ 237,650	6,893	$ 213,890
PV (3%)[b]	NA	$ 1,890,710	NA	$ 1,701,640
PV (7%)[c]	NA	$ 1,549,560	NA	$ 1,394,610

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584).

[c]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

Uncertainty: The estimates of consumer surplus gains to PWC users are uncertain for a variety of reasons. Some of the main sources of uncertainty are as follows:

- The estimates of the number of PWC users expected to visit AMIS under each of the alternatives are uncertain, as are the projections of future PWC use.
- The actual consumer surplus associated with PWC use in AMIS may be different from the value used in the analysis. The value used in the analysis is based on studies of riding in motor boats and waterskiing.
- The values in Table 4-4 may overestimate true gains under Alternative B because of assumptions about the consumer surplus of PWC users who ride in the park. In the analysis of Alternative B, PWC users who use PWC in AMIS may be inconvenienced by the PWC-free zones and additional safety measures. These requirements may decrease the consumer surplus associated with using a PWC in AMIS.
- The 1996 EPA Marine Engine Rule (see Section 2.2.4) may result in lower PWC use if the cost of new machines increases. If fewer riders would visit the park, the incremental consumer surplus gains associated with Alternative A or B would be lower.

Benefits to the local Area Businesses

If PWC use increases as a result of the regulation, then the suppliers of PWC rentals, sales, and service will be directly affected. In addition, lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders could experience an increase in business from the regulation. The following section describes the approach used to develop quantitative estimates of these impacts and reports the results of the cost analysis for local area businesses.

PWC Sales, Rental, and Associated Businesses Serving AMIS. NPS identified one firm that sells and services PWC, one firm that provides PWC rentals, one firm that stores PWC, and one additional firm that services PWC in the AMIS area. As described in Section 3.1, NPS estimated the changes in visitation and local business revenues that would result from each of these alternatives. Table 3-4 summarizes the revenue losses estimated for local businesses.

Lodging Establishments, Restaurants, Gas Stations, and Other Businesses. Purchases made by PWC users contribute to total economic activity in the area surrounding AMIS. It is possible that

localized impacts on tourism-related businesses located near AMIS will occur if PWC regulations result in increased visitation to the recreation area.

NPS does not expect Alternative C to result in revenue gains to firms relative to the baseline. Based on the existing data and interviews with local businesses, NPS calculated revenue gains under Alternatives A and B for the following business categories: PWC rentals, PWC sales, lodging, restaurants, supermarkets, gasoline, local transportation, admissions/fees, clothing shops, sporting goods shops, and souvenir/retail shops. These revenue gains are presented in Table 3-4.

PWC rental shops are projected to gain $13,390 under Alternative A and $12,050 under Alternative B. PWC sales are expected to gain $407,660 under Alternative A and $366,890 under Alternative B. These two categories represent over 95 percent of the total expected gains for businesses. Restaurants and bars are projected to gain $4,860 and $1,620 in revenues, while souvenirs and other retails are projected to gain $2,110 and $700 in revenues, under Alternatives A and B, respectively. The remaining business categories (lodging, supermarkets, gasoline and oil, local transportation and admissions/fees) are expected to gain a total of $14,060 to $4,690, depending on the alternative selected.

To translate increased PWC revenue into producer surplus gains for purposes of benefit-cost analysis, NPS used estimates of the increase in revenue associated with the rule and the return-on-sales measure for the Standard Industrial Classification (SIC) code provided by Dun & Bradstreet (D&B). The use of this profit margin only approximates gains in producer surplus. Producer surplus captures the difference between marginal costs and marginal revenue, while return on sales contains other measures reflecting fixed costs, taxes, and/or accounting conventions rather than measures of variable profits. For this reason, the use of D&B accounting profit margin data may understate producer surplus gains.

The profit ratios presented in Table 4-5, net profit after tax divided by sales, come from D&B (2001).[2] The upper quartile profit ratio for sales shops is 4.6 percent and the lowest quartile is 0.6 percent. The upper quartile profit ratio for rental shops is 8.7 percent and the lowest quartile is –3.4 percent. However, none of the rental shops that NPS interviewed indicated that they had a negative profit margin. Therefore, NPS used the median profit ratio (3.9 percent) as the low value in this analysis.

Table 4-5. Profit Ratios Used for Calculating Producer Surplus Losses

		Profit Ratios	
	SIC	Bottom Quartile	Upper Quartile
PWC rentals	7999	3.90%	8.70%
PWC sales	5571	0.60%	4.60%
Lodging	7011	1.30%	14.70%
Restaurants and bars	5812	0.60%	7.50%
Grocery stores	5411	0.40%	3.00%
Gas and oil	5541	0.10%	3.10%
Souvenir shops and other retail establishments	5947	1.10%	9.90%

For businesses in the AMIS region, estimated producer surplus gains associated with imposing the regulatory alternatives relative to a 2002 baseline are presented in Table 4-6.[3] Total producer surplus gains expected under Alternative A range from $3,160 to $21,980. Under Alternative B, estimated total producer surplus gain ranges from $2,730 to $18,630. The largest increase in producer surplus occurs in the PWC sales/services category, with increases ranging from $2,200 to $18,750 across these alternatives. Producer surplus gains for other affected categories range from $10 to $1,160, depending on the business category, the alternative, and the profit ratio used. Under Alternative C, there are no projected gains in producer surplus because there is no change relative to baseline.

[2]D&B data for North American Industry Classification System (NAICS) codes are not currently available. Therefore, NPS used the comparable SIC code 5571 (Motorcycle Dealers) as defined by the U.S. Census (i.e., SIC 5571, Motorcycle Dealers) for PWC dealerships. For rental shops, NPS used SIC code 7999 (Amusement and Recreation NEC).

[3]Estimated producer surplus losses in future years have a similar distribution across industries.

Table 4-6. Changes in 2002 Producer Surplus in the First Year Resulting from Reinstating PWC Use in AMIS (2001$)[a]

	Alternative A		Alternative B		Alternative C (No Action)	
	Low	High	Low	High	Low	High
PWC rentals, storage and other PWC related purchases	$520	$1,160	$470	$1,050	$0	$0
PWC sales/service	$2,450	$18,750	$2,200	$16,880	$0	$0
Lodging	$90	$1,070	$30	$360	$0	$0
Restaurants and bars	$30	$360	$10	$120	$0	$0
Groceries/take-out	$10	$60	$0	$20	$0	$0
Gas and oil	$0	$50	$0	$20	$0	$0
Souvenirs and other retail	$60	$530	$20	$180	$0	$0
Total	**$3,160**	**$21,980**	**$2,730**	**$18,630**	**$0**	**$0**

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

Table 4-7 summarizes the estimated change in producer surplus for the period from 2003–2012. The present value of incremental gains in producer surplus for Alternative A is between $28,770 and $199,910 with a 3 percent discount rate and $23,580 to $163,840 with a 7 percent discount rate. For Alternative B, the present value of producer surplus gain is estimated to be $24,760 to $169,470 using a 3 percent discount rate and $20,300 to $138,890 using a 7 percent discount rate. There is no change in producer surplus under Alternative C, the no-action alternative.

Uncertainty

A number of factors will affect local business revenue and producer surplus gains associated with the proposed alternatives. Important factors include the uncertainty surrounding the baseline visitation projections as described in Section 2.2, uncertainty concerning the estimation of output increases as described in Section 3.3.8, and the use of national average accounting profit ratios to approximate producer surplus gains to individual local businesses.

NPS Enforcement Costs. As a result of lifting the ban on PWC use in AMIS, costs are expected to be incurred by taxpayers to support an increase in enforcement efforts by park staff. Although NPS expects that additional staff may be required under Alternatives A and B relative to the baseline, the number of staff (if any) that would be hired is uncertain.

Table 4-7. Changes in Producer Surplus Resulting from Reinstating PWC Use in AMIS, 2003-2012 (2001$)[a]

Year	Alternative A		Alternative B		Alternative C (No Action)	
	Low	High	Low	High	Low	High
2003	$3,160	$21,980	$2,730	$18,630	$0	$0
2004	$3,210	$22,310	$2,770	$18,910	$0	$0
2005	$3,260	$22,640	$2,810	$19,190	$0	$0
2006	$3,310	$22,980	$2,850	$19,480	$0	$0
2007	$3,360	$23,320	$2,890	$19,770	$0	$0
2008	$3,410	$23,670	$2,930	$20,070	$0	$0
2009	$3,460	$24,030	$2,970	$20,370	$0	$0
2010	$3,510	$24,390	$3,010	$20,680	$0	$0
2011	$3,560	$24,760	$3,060	$20,990	$0	$0
2012	$3,610	$25,130	$3,110	$21,300	$0	$0
PV (3%)[b]	**$28,770**	**$199,910**	**$24,760**	**$169,470**	**$0**	**$0**
PV (7%)[c]	**$23,580**	**$163,840**	**$20,300**	**$138,890**	**$0**	**$0**

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). Although the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[c]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

Consequently, NPS does not quantify enforcement costs associated with the implementation of Alternatives A and B. Alternative C, which continues baseline conditions, will not result in any additional enforcement costs for AMIS.

4.3 SUMMARY

Alternative C, the no action alternative, entails the continuation of baseline conditions. Under that alternative, all PWC use would remain prohibited from the park. Alternative B would permit PWC use with certain restrictions, and Alternative A would permit PWC use as previously managed in the park (pre-ban). The benefits of any alternative are measured relative to the baseline conditions, which are represented by Alternative C. Therefore, there are no incremental benefits associated with Alternative C. The primary

beneficiaries of Alternative A or B would be the park visitors who use PWC and the businesses that provide services to PWC users such as rental shops, restaurants, gas stations, and hotels. Additional beneficiaries include individuals who use PWC outside the park where PWC users displaced from the park may decide to ride if PWC use within the park were prohibited.

Benefits accruing to individual PWC users are called consumer surplus gains, and those accruing to businesses are called producer surplus gains. Consumer surplus measures the net economic benefit obtained by individuals from participating in their chosen activities, while producer surplus measures the net economic benefit obtained by businesses from providing services to individuals. Over the period 2003 to 2012, the present value of consumer surplus for PWC users is expected to increase by $1,394,610 to $1,890,710 and producer surplus is expected to increase by $20,300 to $199,910 if PWC use in the park is reinstated, depending on the assumptions used. These benefits, projected over a 10-year horizon, are summarized in Table 4-8.

Table 4-8. Present Value of Projected Incremental Benefits Under Alternatives A and B, 2003–2012 (thousands)

	PWC Users	Businesses	Total
Alternative A			
Discounted at 3%[a]	$1,890.7	$28.8 – $199.9	$1,919.5 – $2,090.6
Discounted at 7%[b]	$1,549.6	$23.6 – $163.8	$1,573.2 – $1,713.4
Alternative B			
Discounted at 3%[a]	$1,701.6	$24.8 – $169.5	$1,726.4 – $1,871.1
Discounted at 7%[b]	$1,394.6	$20.3 – $138.9	$1,414.9 – $1,533.5

[a]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[b]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

As with the benefits described above, the costs of any alternative are measured relative to the baseline conditions, which are represented by Alternative C. Therefore, there are no incremental costs

associated with Alternative C. The primary group that would incur costs under Alternative A or B are the park visitors who do not use PWC and whose park experiences would be negatively affected by PWC use within the park. At AMIS, non-PWC uses include boating, canoeing, fishing, and hiking. Additionally, the public could incur costs associated with impacts from Alternative A or B to aesthetics, ecosystem protection, human health and safety, congestion, nonuse values, and enforcement. However, these costs could not be quantified because of a lack of available data.

Because the costs of the alternatives are not quantified, the benefits presented in Table 4-8 represent the quantified net benefits of Alternatives A and B. As noted above, these net benefits do not account for the costs of enforcement; the costs to non-PWC users; or those costs relating to aesthetics, ecosystem protection, human health, and safety, congestion, or nonuse values as a result of a lack of available data. Therefore, these net benefit estimates do not reflect all costs. If all costs could be incorporated, the indicated net benefits for each alternative would be lower.

From an economic perspective, the selection of Alternative A as the preferred alternative was considered reasonable because certain costs could not be quantified in the net benefits presented above. Those costs, relating to non-PWC use, aesthetics, ecosystem protection, human health and safety, congestion, or nonuse values, would likely be greater for Alternative A than for Alternative B. However, the quantified benefits for Alternative A were higher than for Alternative B (see Table 4-6), further inclusion of these un-quantified costs could reasonably result in Alternative A having the greatest level of net benefits. Therefore, based on these factors, Alternative A was considered to provide the greatest level of net benefits.

5 Small Entity Impact Analysis

Alternatives A and B are expected to have positive effects relative to baseline conditions.

Changes to the management of PWC use in national parks potentially affect the economic welfare of a number of businesses, large and small. However, small entities may have special problems in complying with such regulations. The Regulatory Flexibility Act (RFA) of 1980, as amended in 1996, requires special consideration be given to these entities during the regulatory process.

To fulfill these requirements, agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. This section assesses the potential for PWC regulations in AMIS to affect small businesses. Expected changes in revenues across firms and regional economic impacts are discussed in Section 3, and expected changes in producer surplus are discussed in Section 4.

5.1 IDENTIFYING SMALL ENTITIES

As described in Sections 2 and 3, NPS attempted to identify the firms in the region surrounding AMIS that would experience the most significant impacts as a result of PWC regulations in AMIS. Small entities potentially affected by the regulations include companies providing PWC rentals, sales, and service; restaurants; grocery stores; and other retail businesses. The relatively small expected changes in total visitation to the AMIS area as a result of implementing Alternative A or B suggest that there will be no noticeable regional impacts on lodging establishments and restaurants. It is possible that these tourism-related industries may

experience localized impacts in communities located adjacent to AMIS, but any impacts are expected to be small relative to the impacts estimated for businesses that provide PWC sales, rentals, and service. The impacts on the PWC-related businesses considered are believed to be representative of the upper bound of impacts that would be experienced by local businesses under Alternative A or B. Under Alternative C, the no-action alternative, no incremental impacts are expected for small businesses because it maintains baseline management conditions under which PWC were banned from AMIS in November 2002.

In addition, there are wide variations in recreational visitation to AMIS from year to year. This variation in visitation likely causes similar year variations in revenue for local firms that rely on tourism. The fact that firms are still in business despite these low visitation/low revenue years provides some anecdotal evidence that small firms would remain in business if they experienced a small drop in revenue. The businesses most likely to be directly affected by PWC regulations are those offering PWC rental, sales, and/or services and convenience/bait/gasoline stores. NPS identified one PWC rental shop, two PWC sales and/or service firms, four convenience/sporting goods stores, and one firm that offers PWC storage located in communities near AMIS.

The SBA's (2002) general size standard definitions classify companies as small based on the following sale criteria:

- NAICS 532292 Recreational Goods Rental[1]—$5 million,
- NAICS 441221 Motorcycle Dealers[2]—$5 million,
- NAICS 445120 Convenience Stores[3]—$23 million, and
- NAICS 451110 Sporting Goods Stores[4]—$6 million.

[1]This industry comprises establishments primarily engaged in renting recreational goods, such as bicycles, canoes, motorcycles, skis, sailboats, beach chairs, and beach umbrellas.

[2]This industry comprises establishments primarily engaged in retailing new and/or used motorcycles, motor scooters, motor bikes, mopeds, off-road all-terrain vehicles, and personal watercraft, or retailing these new vehicles in combination with repair services and selling replacement parts and accessories.

[3]This industry comprises establishments known as convenience stores or food marts (except those with fuel pumps) primarily engaged in retailing a limited line of goods that generally includes milk, bread, soda, and snacks.

NPS computed total revenue for each firm in one of the following ways:

- Interview Data—for five of the eight local businesses, NPS obtained total firm revenue directly from the owner or manager.
- *info*USA Data—for the remaining three firms, NPS used the sales figure reported for the firm by *info*USA. If a range was given for the annual sales, the midpoint of the range was assumed to be the best approximation of annual sales.

Based on this approach, we estimated these eight firms had a total of $6.88 million in annual revenue in 2001.

Four of the eight firms that NPS identified are estimated to have less than $0.5 million in annual sales (50 percent), and the other four are estimated to have between $1.0 million and $1.75 million in annual sales. After additional review and data collection, NPS determined that the PWC rental firm is owned by a parent company with sales of approximately $7.5 million, which is above the threshold for a recreational goods rental firms to be considered a small entity. Thus, NPS classified seven of the eight identified affected firms as small for this analysis.

5.2 ASSESSMENT

Do the proposed regulations have a negative impact on a substantial number of small entities?

Alternative A: No

Alternative B: No

Alternative C: No

After considering the economic impacts of the PWC regulations on small entities, this analysis concludes that Alternatives A and B will not have a negative impact on a substantial number of small entities. Alternatives A and B will have a small positive impact on small businesses relative to the baseline scenario, under which PWC were banned from AMIS in November 2002. The no-action alternative (Alternative C) will not have a negative impact on a substantial number of small entities because it will not result in a change from baseline conditions. NPS made the determination that these management alternatives would not have a negative impact on small entities using RFA implementation guidance provided by other agencies (NMFS, 2000; EPA, 1999b; SBA, 2003) and provides the following factual basis for this determination:

[4]This industry comprises establishments primarily engaged in retailing new sporting goods, such as bicycles and bicycle parts; camping equipment; exercise and fitness equipment; athletic uniforms; specialty sports footwear; and sporting goods, equipment, and accessories.

- This rule is not expected to reduce any of the area businesses' profit margins or reduce the competitiveness of the PWC rental and retail businesses.
- NPS projects small increases in revenue relative to the baseline for firms selling and renting PWC to AMIS visitors under Alternatives A and B.
- NPS projects slightly higher overall levels of revenue for other businesses (including restaurants, grocery stores, gas stations, and souvenir shops) in the AMIS region relative to the baseline under Alternatives A and B.
- NPS projects no change in revenue for local small businesses relative to baseline conditions under Alternative C, the no-action alternative.

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Appendix A: Economic Impact Analysis

Expenditures made by visitors to national parks have a variety of economic impacts on the region where the park is located. For instance, tourists contribute to sales, profits, jobs, tax revenues, and income in a region. The most direct effects are felt within the primary tourism sectors: lodging, dining, transportation, entertainment, and retail trade. However, when indirect effects are included, almost all sectors of the economy are affected by tourism. This occurs because spending by tourists on the primary tourist sectors leads those sectors to purchase inputs into their production process from other industries, which then purchase more inputs themselves and so on. In addition, as local household income rises because of the impact of tourism, these households purchase more goods and services from many different industries. This leads to higher incomes for households deriving income from these other industries, which causes them to purchase more goods and services as well. These feedback effects continue indefinitely, but become smaller and smaller in each round as a result of leakage because not all income is spent within the regional economy. These effects on household spending are known as induced effects.

A simple example from Stynes (2000) illustrates this point. Assume a region attracts an additional 100 tourists, each spending $100 per day. The direct impact of this increase in tourism is $10,000 per day in new spending. If sustained over a season of 100 days, the region would experience an increase in sales of $1 million. This spending would primarily take place in the lodging, dining, entertainment, and retail sectors in proportion to how each visitor spends his/her $100. Not all of the value of this spending can be

assumed to accrue within this region because the cost of goods made in other regions should not be included as a direct sales effect in the local area. For example, gasoline purchased by tourists for $1.50 per gallon should not be included as a local spending impact of $1.50 per gallon. Instead, only the retail margin on the gasoline can be considered a direct effect of tourism spending. The margins on gasoline are relatively small. Assuming a retail margin of 12 percent suggests that the direct impact of spending on gasoline to the local area is only about 18 cents per gallon. Wholesale margins are also included for wholesalers located within the region of interest.

Returning to the example above, perhaps 30 percent of the million dollars in direct spending would leak out of the area to cover the costs of goods purchased by tourists that were produced outside the region. The remaining $700,000 increase in direct sales might yield $350,000 in income within tourism-related industries and support 20 jobs directly linked to tourism. Tourism industries tend to be labor intensive, translating a relatively high proportion of sales into income and jobs.

The tourism industry buys goods and services from other industries located in the area to provide the goods and services offered to tourists. For example, changes in sales, jobs, and income in the linen industry (an industry supplying products to hotels) will result from changes in hotel sales. Also, as mentioned above, this industry is typically very labor intensive. Therefore, most of the $350,000 in income will be paid as wages and salaries to tourism industry employees. As a result of this increase in income, these employees will spend more in the local region for an array of household products and services. Assuming a sales multiplier of 2.0 to indicate that each dollar of direct sales generates another dollar of secondary sales implies that the $700,000 in direct sales within the region leads to a $1.4 million increase in regional sales as a result of the additional tourists visiting the area. These secondary sales create additional income and employment in the region, with the estimated impact dependent on the multipliers for each particular region. Assume in our case that the total impact of the increase in tourism after applying multipliers is $1.4 million in sales, $650,000 in income and 35 jobs.

Although hypothetical, the numbers used in this example are fairly typical of those used in a tourism economic impact study. Through indirect and induced effects, changes in tourist spending can affect almost every sector of the economy to some extent. The magnitude of these effects depends strongly on the extent to which businesses and households in the region purchase goods and services from local suppliers as well as how much household income is affected by the changes in spending. When a large employer closes a plant, the entire local economy may be negatively affected as retail stores close and leakages of spending from the region increase as consumers go outside the region for more of their goods and services. Similar effects in the opposite direction are observed when a new facility opens and there is a significant increase in household income (Stynes, 2000).

In addition to simply estimating the total regional impact, more detailed studies identify the sectors that receive the direct and secondary effects. They may also identify distinct market segments and identify differences in spending and impact between these subgroups. This information is sometimes used to target marketing efforts towards tourists with particular characteristics that are likely to lead to the largest economic impact per marketing dollar. It may also be used simply to better understand the distribution of impacts and to gain a better measure of the expected effects of a change in regional spending. Effects on tax revenues may also be examined by applying local tax rates to changes in sales and income.

The economic impacts resulting from a change in spending are typically measured by

- ➤ estimating the change in the number and types of visitors to the region due to the proposed change in policy,
- ➤ estimating average levels of spending (often within market segments) of visitors in the local area, and
- ➤ providing the estimated change in direct spending as input into a regional economic model to determine secondary effects.

Estimates of changes in visitor activity usually come from a demand model or professional judgment about the changes in visitation likely to take place. This step is often the weakest link in tourism impact studies because most regions do not have accurate counts of

visitors, let alone models for predicting changes in visitation (Stynes, 2000).

Spending averages are usually derived from visitor surveys or may be adapted from other similar studies. Because of differences in visitors, these data are often provided for different segments of the visitor population due to variations in spending patterns based on whether visitors stay overnight, the accommodations they choose, the type of transportation they are using, and other characteristics of their stay.

One of the primary methods used to estimate the secondary economic impacts of a particular action or policy is to apply an input-output (I-O) model. I-O models are mathematical models that describe the relationship between sectors in a region's economy. Regional I-O models are commonly used to estimate the benefits or costs of an event on the economy of a given region. These models are used to estimate linkages among sectors of the economy such that an event directly affecting one sector of the economy can be traced through the impact on the entire regional economy. This approach permits estimation of both the direct impacts in the affected sector as well as indirect impacts that occur as the change in spending by the directly affected industry works its way through the economy. Based on production functions estimating the inputs that each industry must purchase from every other industry to produce their output, these models predict flows of money between sectors. These models also determine the proportion of sales that end up as income and taxes. Multipliers are estimated from I-O models based on the estimated recirculation of spending within the region. The higher the propensity for households and firms within the region to purchase goods and services from local services, the higher the multipliers for the region will be. A number of important assumptions are involved in using I-O models. Some of the basic assumptions include the following:

- **Constant Returns to Scale.** Each industry's production function is assumed to have constant returns to scale. This means that, to produce additional output, all inputs increase proportionately (i.e., if output in an industry were to double, then that industry would double its use of all inputs). Because labor is one of the inputs into production, this implies that jobs will change in exactly the same proportion as output.

- **No Supply Constraints.** Supplies are unlimited. All industries have access to unlimited quantities of raw materials at a constant price with output limited only by demand.
- **Fixed Commodity Input Structure.** This assumption implies that price changes do not cause a firm to purchase substitute goods. This structure assumes that changes in the economy affect the industry's output but not the mix of inputs it uses to make its products.
- **Homogeneous Sector Output.** The proportion of all the commodities produced by an industry will remain the same, regardless of total output. An industry will not increase the output of one product without proportionately increasing the output of all its other products.
- **Industry Technology Assumption.** This assumption is important when data are collected on an industry-by-commodity basis and then converted into industry-by-industry data. It assumes that an industry uses the same technology to produce all of its products. In other words, an industry has a primary product and all other products are by-products of the main product.
- **Identical Firms.** All firms in a given industry employ the same production technology and produce identical products.
- **Model Parameters.** The various model parameters are accurate and represent the current year. These models rely on the national system of accounts to generate model parameters based on standard industrial classification codes and various federal government economic censuses. They are usually at least a few years out-of-date, although this is not usually a major problem unless the region has changed significantly.
- **Induced Effects.** Multiplier computations for induced effects assume that jobs created by additional spending are new jobs involving local households. The induced effects of new spending are calculated assuming linear changes in household spending with changes in income.

These assumptions are necessary to estimate an economic impact model using a typical regional I-O model. However, these assumptions lead to several limitations as noted by Hamilton et al. (1991); Coughlin and Mandelbaum (1991); and Stabler, Van Kooten, and Meyer (1988), among others. Most of these issues apply to alternative models as well and should be considered in interpreting the results of economic impact analyses in general. Some of the biggest limitations associated with this type of analysis are discussed below.

First, all production inputs have an associated opportunity cost. Thus, these opportunity costs should be included in the net benefits calculation, although this is often not considered in an economic impact analysis. Net benefits equal impacts less opportunity costs. In the case of full employment, perfect resource mobility, and absence of scale economies, benefits of a policy, action, or project would be zero because all factors employed as a result could have received the same return without the policy, action, or project in alternative uses. Typically, applications analyzing regional economic analysis assume that there is not full employment and complete mobility in the region being analyzed, but the change in net benefits will still be reduced if opportunity costs are considered.

Another issue is that multipliers estimate short-term changes, ignoring a regional economy's long-term adjustments. Thus, most of the economic effects identified in economic impact analysis are likely to be only transitory as the regional economy adjusts to the change. For example, if jobs are lost in a region because of new regulations, some of this reduction will be temporary because some of the workers whose jobs were eliminated will find new jobs in the region.[1]

Also, if some workers relocate in response to a change in the regional economy, then it is not entirely clear who should be counted in the region when calculating the benefits and costs associated with a change. For example, a new project located in a particular region may attract resources from outside the region. It is not clear that income to these immigrant resources should be counted as regional benefits of the project because people originally from the region do not benefit. However, I-O models typically make no distinction between jobs and sales, for example, going to those people already within the region and benefits going to those people outside the region.

Furthermore, applying multipliers is difficult if industries will move to different points on their cost curves as a result of the change and there are economies or diseconomies of scale. Because I-O models are based on fixed coefficients, they are not able to capture these

[1]Some workers may not find jobs within the region, even in the long run. The loss of workers who leave for jobs in other regions may tend to slow the region's growth, but such restructuring ultimately improves national economic performance by redistributing resources to their most efficient use.

impacts. These models assume that there are no supply constraints such that industries will not change their relative purchases from other sectors. This requires excess regional production capacity and excess regional labor so that use of these resources can be increased without a change in prices. In many areas, this is unlikely to be the case. Instead, increasing scale may lead to an increase in the price of labor and other resources and may cause a change in the mix of inputs used for production. It may also lead to the use of a different proportion of inputs being purchased from outside the region, which will affect the estimated change in final demand for regional output.

Some additional difficulties with applying regional multipliers include the following:

- multipliers are based on political boundaries (e.g., counties, states) instead of economic areas;
- multipliers may not be constant over time;
- different production functions for different activities are lumped together; and
- information on the relationships between producers in a region is lacking, which makes constructing an accurate set of multipliers very difficult.

Despite these caveats on the use of multipliers, regional I-O models are still considered the best way currently available to cost-effectively estimate the regional impacts of a change that will affect the local economy.

Appendix B: Social Benefits and Costs of Personal Watercraft Restrictions

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. That is, it assesses whether the action generates benefits to society (gains in social welfare) that are greater than the costs (losses in social welfare). The following sections provide detailed descriptions of the range of social benefits and social costs that may result from PWC restrictions and discuss the ways in which these benefits and costs can be conceptualized and measured.

B.1 SOCIAL BENEFITS OF PWC RESTRICTIONS

PWC use in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental systems. The benefits of PWC restrictions can therefore be thought of and measured as the reduction in these losses to society. In addition, PWC use can negatively affect society in ways that are not directly related to the environment; therefore, the benefits of PWC restrictions must also include reductions in these nonenvironmental losses. Both broad categories of benefits—environmental and nonenvironmental—are discussed in more detail below.

B.1.1 Environmental Benefits

The use of PWC may have adverse impacts on the aesthetic qualities of the park, on human health, and on the park's ecosystems. The benefits associated with avoiding these impacts are described below.

Aesthetic Benefits

Among the largest and most directly damaging impacts associated with PWC use in national parks are its effects on the aesthetic qualities of park air and specifically the park soundscape. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000b). The improvement or preservation of these aesthetic qualities, either in the form of reduced noise pollution or improved visibility, is therefore a potentially important source of benefits from reducing PWC use.

Noise Reduction. Perhaps the most noticeable and intrusive aspect of PWC is the level of sound they emit during normal operation. PWC have been measured to emit 65 to 105 decibels (dB) per unit, which may disturb visitors on the land and on the water. Noise limits established by NPS require vessels to operate at less than 82 dB at 82 feet (from the shoreline). The amount of noise from a PWC can vary considerably depending on its distance from another park visitor and whether it is in the water or in the air. Noise dissipates by 5 dBs for each doubling of distance from a 20-foot circle around the source and a PWC that is airborne is 15dBA louder than one that is in the water (Komanoff and Shaw, 2000). To put these noise-level estimates into perspective, Table B-1 also compares them with those of other familiar sounds.

PWC users tend to operate close to shore, to operate in confined areas, and to travel in groups, making noise more noticeable to other recreationists. Noise impacts from PWC use are caused by frequent changes in pitch and loudness due to rapid acceleration, deceleration, and change of direction. PWC noise intrudes in

Table B-1. Comparative Noise Emissions

Source	Decibel Level
Firearms	140
Motorcycle	90–110
Snowmobiles	73–100
Vacuum cleaner	70
PWC	65-105
Normal conversation	60
Normal breathing	10

otherwise quiet soundscapes, such as in secluded lakes, coves, river corridors, and backwater areas. Also, PWC use in areas where there are nonmotorized users (such as canoeists, sailors, and kayakers) causes conflicts between users.

Those who are most likely to benefit from reductions in PWC-related noise pollution in national parks are other park visitors and recreators, in particular those engaged in recreational activities that take place by the water, such as fishing, hiking, birdwatching, canoeing, kayaking, and swimming.

Several studies have shown that noise from motorized vehicles diminishes the recreational experience of other users. Several studies have found disamenities associated with various forms of mechanized recreational activities or other "technology-related" noises in recreation areas (Beal, 1994; Ivy, Stewart, and Lue, 1992; Bury and Luckenbach, 1983; Baldwin, 1970; Bury, Wendling, and McCool, 1976; Dunn, 1970; Lucas and Stankey, 1974; O'Riordan, 1977; Sheridan, 1979; Wagar, 1977).

Relatively few studies have specifically estimated the (negative) value of noise externalities on other recreators. One exception is a recent analysis conducted by the Federal Aviation Administration (FAA) to estimate the benefits of a regulation to restrict commercial air tours in Grand Canyon National Park (GRCA) (FAA, 2000). Using visitor-day value estimates from existing studies ranging from $37 to $92 (for backcountry, river, and other users of the park), the analysis assumed that these visitor-day values would be reduced in

relation to the how much aircraft noise interfered with the enjoyment of GRCA. Information about how aircraft noise affected different recreators was provided by a separate survey study of GRCA visitors. The survey found, for example, that for backcountry visitors 21 percent were "slightly" affected and 2.5 percent were "extremely" affected by the aircraft noise. In the FAA analysis, visitor value-days were assumed to be reduced by 20 to 80 percent depending on the percentage of respondents who indicated that their enjoyment of the park was "slightly," "moderately," "very," or "extremely" affected by the noise.

Another example of such a study that focuses specifically on the noise impacts of PWC is one that has examined the losses that PWC users impose on other beach recreators (Komanoff and Shaw, 2000). This study assumed that an average beach day (per person) is worth between $10 for a popular beach and $30 for a secluded one and that each 10 dB increase in background noise decreases these values by 10 percent. The assumptions about the size of the decrease in value from increases in noise come from studies on the increased property values for houses in quiet neighborhoods. Assuming also that each 1 dB noise level increment reduces the value of a beach day by 1 percent, the study found that beachgoers suffer an average loss in recreation value of between $0.50 and $7.40 per jet ski cluster (1.6 jet skis over the course of a day) per person per day.

Other evidence regarding the noise-related losses imposed by PWC can be gleaned from studies that have examined the effects of congestion on recreation values. In these studies, congestion is often measured as the number of encounters with other recreators, which may be thought of as being roughly equivalent to hearing the sound of PWC. For example, in a study of backcountry recreators in the Caribou-Speckled Mountain Wilderness in Maine, Michael and Reiling (1997) found that weekend visitors experienced losses of $22.3 (in 1990 dollars) per visit if they encountered more groups than expected.

Visibility Improvements. Several studies by the NPS and others have demonstrated the importance of visual air quality for visitors' (and nonvisitors') enjoyment and appreciation of national parks. Nevertheless, visual air quality has been and continues to be

threatened at many national parks across the country. Emissions from PWC in these parks are one of many potential (albeit, a relatively small) sources of these visibility impairments.

Although visibility effects can be characterized and measured in several different ways, "regional haze," which uniformly reduces visual range and therefore impairs the appreciation of natural vistas, has been a particular source of concern. The primary contributors to regional haze and visibility impairments in general are small particles (particulate matter or PM) in the atmosphere that scatter and absorb light. There are several different sources and types of particles in the environment; however, sulfates (and to a lesser extent nitrates), primarily from the combustion of fuels, are the largest contributors to visibility reduction, especially in the eastern portions of the U.S. (Malm, 1999). Nationwide, the largest sources of sulfur dioxide emissions that contribute to sulfates in the atmosphere are power plants and other industrial sources. Mobile sources, such as cars, trucks, and buses (and PWC), account for the largest portion of NO_x emissions, which contribute to nitrates.

Emissions factors per hour are not available for PWC but because PWC are powered by the same type (two-stroke) of engine as snowmobiles, snowmobile emissions factors may serve as a reasonable proxy. Table B-2 compares typical emissions rates for snowmobiles and other vehicles for NO_x and PM. These are the pollutants that are the most likely contributors to visibility impairments from PWC emissions. These emissions rates vary greatly across types and uses of these vehicles; however, the table shows that PM emissions for snowmobiles are particularly high relative to automobiles. The California Air Resources Board found that a 7-hour ride on a PWC powered by a conventional two-stroke engine produces the same amount of smog-forming emissions as over 100,000 miles driven in a modern passenger car. It should also be noted, however, that automobiles account for a very small portion of PM emissions nationwide.

The estimates in Table B-2 suggest that PWC can be a source of visibility impairment in national parks, but their contribution to overall levels of regional haze in these areas is likely to be negligible. Nevertheless, in high-use areas and periods, they may negatively affect visual air quality in a noticeable way.

Table B-2. Comparative Emissions Factors for Snowmobiles and Other Vehicles: NO_x and PM

	NO_x	PM
Snowmobiles (lbs per 4 hr visit)	0.06	0.2
Automobiles (lbs per 4 hr drive[a])	0.09–0.41	0.02
Diesel buses (lbs per 4 hr drive[a])	3.22	0.26

[a]Assuming an average speed of 25 mph.
Source: NPS, 2000a.

Several studies have investigated U.S. households' values for improvements in visibility at various national parks across the country. All of these studies have found a significant WTP by both users and nonusers for visibility improvements. One study in particular (Chestnut and Rowe, 1990) found that the average household in the southeast United States would be willing to pay $68 (in 1999 dollars) per year for a doubling of the visual range in national parks in the southeast United States.

Human Health Benefits

In addition to NO_x, ozone, and PM, PWC emissions typically contain a number of other pollutants, including CO, a conventional air pollutant that is commonly associated with mobile sources. It also includes a number of potentially toxic HC pollutants—benzene, 1,2-butadiene, formaldehyde, and acetaldehyde—and ammonia. As described in Table B-3, inhalation of these pollutants is associated with a wide variety of potential adverse health effects.

The extent to which the health effects listed in Table B-3 result from PWC emissions depends on the level and duration of exposure. Unfortunately, there is too little data and too much uncertainty to reliably estimate the incidence of these health effects. For comparative purposes, however, Table B-4 compares emissions rates of HCs and CO for snowmobiles (as in Table B-2, snowmobile emissions factors serve as a proxy for those of PWC) and for other vehicles.

The comparisons for CO are particularly relevant since highway vehicles account for over 50 percent of total CO emissions in the country (EPA, 2000b). Although the measures of vehicle use in the emissions factors are different across vehicles, the rates of HC and

Table B-3. Health Effects Associated with Pollutants in PWC Emissions

	Carcinogenic Effects	Other Chronic Health Effects	Acute Health Effects
Particulate matter (PM)	None	Chronic bronchitis	High-level exposure: mortality, acute bronchitis Low-level exposure: cough
Carbon monoxide (CO)	None	Aggravation of cardiovascular disease	High-level exposure: visual and mental impairment
Nitrogen oxides (NO_X)	None	Reduced pulmonary function	High-level exposure: cough, fatigue, nausea Low-level exposure: lung irritation
Benzene	Known human carcinogen	Anemia and immunological disorders	High-level exposure: dizziness, headaches, tremors
1,3-Budatdiene	Probable human carcinogen	Birth defects, kidney and liver disease	High-level exposure: neurological damage, nausea, headache Low-level exposure: eye, nose, throat irritation
Formaldehyde	Probable human carcinogen	NA	NA
Acetaldehyde	Possible human carcinogen	Anemia	High-level exposure: pulmonary edema, necrosis Low-level exposure: eye, skin, lung irritation
Ammonia	None	NA	High-level exposure: eye and lung irritation

NA = Not available

Sources: EPA, 2000a; EPA, 1999a.

Table B-4. Comparative Emissions Factors for Snowmobiles and Other Vehicles: HC and CO

	HC	CO
Snowmobiles (lbs per 4 hr visit)	19.84	54.45
Automobiles (lbs per 4 hr drive[a])	0.09–0.44	0.75–3.24
Diesel buses (lbs per 4 hr drive[a])	1.23	4.45

[a]Assuming an average speed of 25 mph.

Source: NPS, 2000a.

CO emissions for snowmobiles are distinctly higher than for automobiles and diesel buses. As a result, national park visitors recreating near areas where PWC use is permitted may be exposed to particularly high levels of CO and certain HCs.

Restrictions on PWC use in national parks could potentially reduce harmful exposures to park visitors and workers, particularly for individuals who spend extended periods in high-use areas. The benefits of these restrictions can be expressed as the value of reductions in the incidence (i.e., the number of cases avoided) of harmful health effects, in particular those effects described in Table B-3. As previously mentioned, the total number of avoided health effects is not known; however, using information from a recent EPA study of the benefits of air pollution regulations (EPA, 1997), Table B-5 provides a summary of "unit" values for selected health effects. Based on a review and synthesis of several health valuation studies, these values represent best estimates of individuals' average WTP to avoid a single case of the health effect. In the absence of more complete information on the total health benefits of reducing PWC use, these values provide a rough sense of the magnitude and relative size of the benefits associated with avoiding specific health effects that may result from acute exposures.

Table B-5. Unit Values for Selected Health Effects

Health Effect	Unit Value (mean estimate) (1999$)[a]
Acute bronchitis	$57
Acute asthma	$41
Acute respiratory symptoms	$23
Shortness of breath (one day)	$6.8

[a]All amounts inflated using the consumer price index available from the U.S. Bureau of Labor Statistics, 2000.

Ecosystem Protection Benefits

To the extent that damages to park ecosystems occur, their cumulative effect is to reduce the "ecological services" that these systems provide to individuals and households across the country. National park ecosystems are particularly valued for their unique

biological, cultural, and geological resources and the recreational and other services they provide. A vast majority of park visitors (i.e., users) experience and enjoy the natural systems of the park through a wide variety of recreational activities (wildlife viewing, hiking, fishing, as well as using PWC). However, even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for park protection is provided in studies that have documented significant WTP by nonusers for improved air quality at parks (e.g., Chestnut and Rowe, 1990) and, more generally, for the protection of unique species and ecosystems (see, for example, Pearce and Moran [1994] for a review of such studies). Restrictions on PWC use in national parks can therefore provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources.

B.1.2 Nonenvironmental Benefits

Restrictions on PWC use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. These potential nonenvironmental benefits are described below.

Public Safety Benefits

With the increase in PWC use in recent years has come an increased concern relating to the health and safety of operators, swimmers, snorkels, divers, and other boaters. A study conducted by the National Transportation Safety Board (NTSB) in 1998 revealed that although recreational boating fatalities have been declining, PWC related fatalities have increased in recent years (NTSB, 1998). PWC accident statistics provided by the U.S. Coast Guard supports the increase in PWC-related fatalities. Within the U.S. five PWC-related fatalities occurred in 1987 and 68 PWC-related fatalities occurred in 2000. However, the peak occurred in 1997, with 84 PWC-related fatalities. Since 1997, PWC-related accidents, injuries, and fatalities have decreased. Following this same pattern, the percentage of PWC out of all boats involved in

accidents have decreased from 36.3 percent in 1996 to 29.6 percent in 2000. The increases and decreases in PWC accidents, injuries, and fatalities are comparative to the number of PWC sales and number of PWC owned (Schmidt, 2001).

Restrictions on PWC use in national parks would certainly reduce the number of such incidents in the parks.[1] The primary beneficiaries would be the PWC users themselves, whose safety would be protected; however, these benefits may be implicitly accounted for in the consumer surplus changes (see Section B.2) that these recreators experience as a result of the restrictions.[2] Other summer recreators (non-PWC) might also benefit if they would otherwise be at risk of being involved in accidents with PWC. In addition, PWC accidents can impose costs on NPS and other local state and local government agencies that are responsible for providing medical, rescue, and related assistance. Reductions in PWC accidents in national parks would therefore allow some of the resources devoted to these activities to be diverted to other publicly beneficial uses.

Avoided Infrastructure Costs

Allowing PWC in national parks requires NPS to develop, maintain, and operate an infrastructure to support these activities. In particular launch sites and buoys must be designated, maintained, and monitored. The costs associated with these activities vary widely across parks, depending on the physical characteristics of the parks and the level of PWC use permitted.

By restricting PWC use, some of these infrastructure-related costs can be avoided or reduced. As a result some of the resources devoted to these activities can also be diverted to other publicly beneficial uses.

[1] The benefits of these reductions may be offset to some degree by increased PWC usage and accidents in areas outside the parks.

[2] To the extent that PWC users are aware of the safety risks they face, the potential losses to themselves from accidents should already be factored into their consumer surplus from using a PWC. This implies that the safety benefits to these individuals from reducing PWC use are implicitly accounted for (i.e., deducted from) the consumer surplus losses to these recreators.

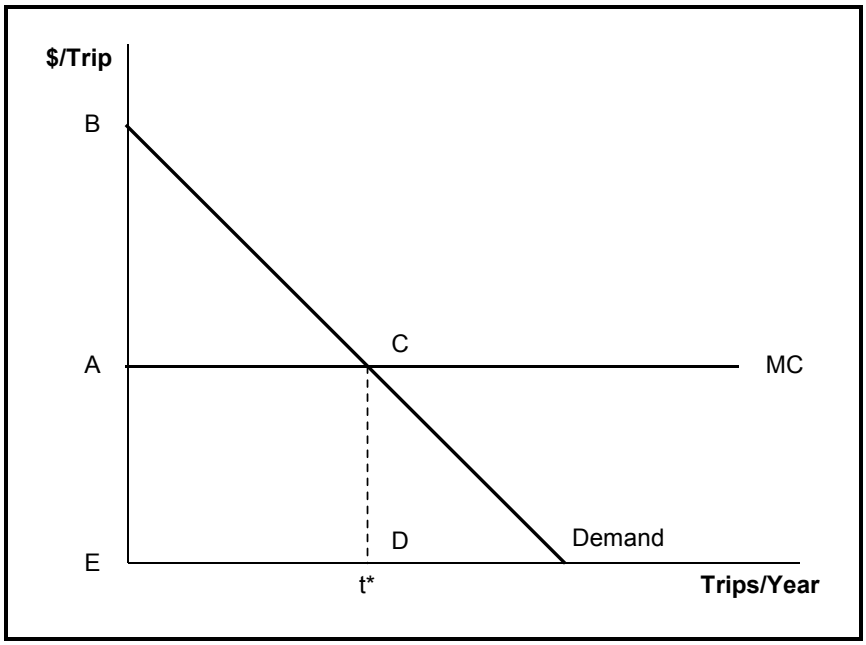
B.2 SOCIAL COSTS OF PWC RESTRICTIONS

The primary losses associated with PWC use restrictions in national parks will accrue to

- ➤ PWC users, in particular individuals who will not PWC in the park as a direct result of the restrictions, and
- ➤ providers of PWC-related services for park visitors.

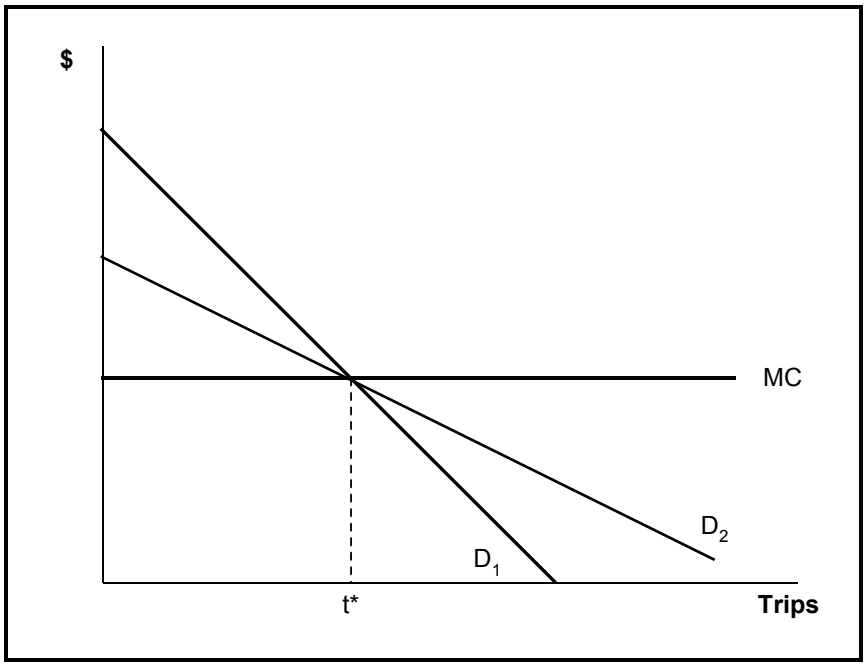
The welfare losses to individual consumers (PWC riders) are measured by their loss in consumer surplus. Consumer surplus is measured as the difference between the total cost of a product or activity to the consumer and the total amount the individual would be willing to pay for that activity. In the context of recreation activities, Figure B-1 depicts an individual demand curve for PWC trips, the marginal cost of a trip (MC, assumed to be constant), and the optimal number of trips per year, t*. The triangle ABC measures the consumer surplus associated with this optimal number of trips—the difference between what the individual paid for the trips, ACDE, and the total WTP for the trips (the area underneath the demand curve), EBCD.

Figure B-1. Consumer Surplus



The extent of the welfare loss to an individual rider depends crucially on the availability of substitute activities. Figure B-2 depicts two alternative demand curves for PWC trips to a particular waterbody. The slope of the demand curve reflects the number of substitute activities available to a particular individual and the preferences of that individual toward those substitutes. The flatter demand curve, D_2, indicates that this individual has a variety of close substitutes for PWC use in this area (these substitutes could include PWC riding in a different area or participating in a different activity such as motorboating). The individual with the steeper demand curve, D_1, has fewer substitute activities he/she enjoys as much as using his/her PWC in this waterbody. If both individuals choose the same number of trips, as in Figure B-2, the person with the steeper demand curve, D_1 (fewer substitutes for PWC use) receives greater consumer surplus from use in this particular waterbody and thus will experience a greater loss in welfare if the waterbody is closed.

Figure B-2. Consumer Surplus and Substitute Activities



The change in welfare for businesses is measured by producer surplus, or the area AP*B in Figure B-3, where P* is the market price of the good, for example a PWC rental. Producer surplus measures the difference between total revenue and variable costs. If the firms face an upward- sloping marginal variable cost (MC) curve, then a decrease in demand, indicated in Figure B-4 from D to D' will result in a lower producer surplus for PWC rental companies.

Figure B-3. Producer Surplus

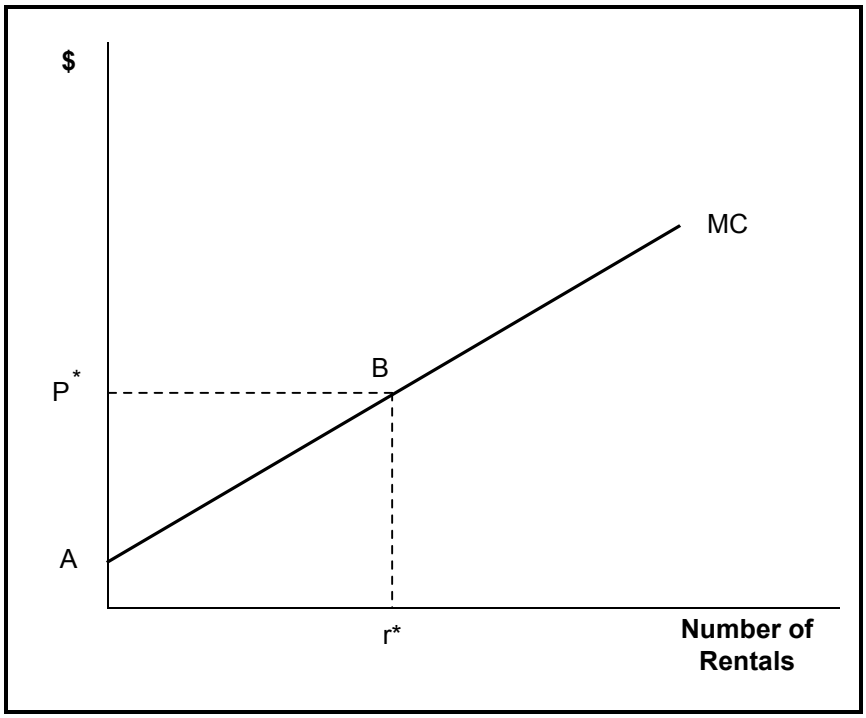
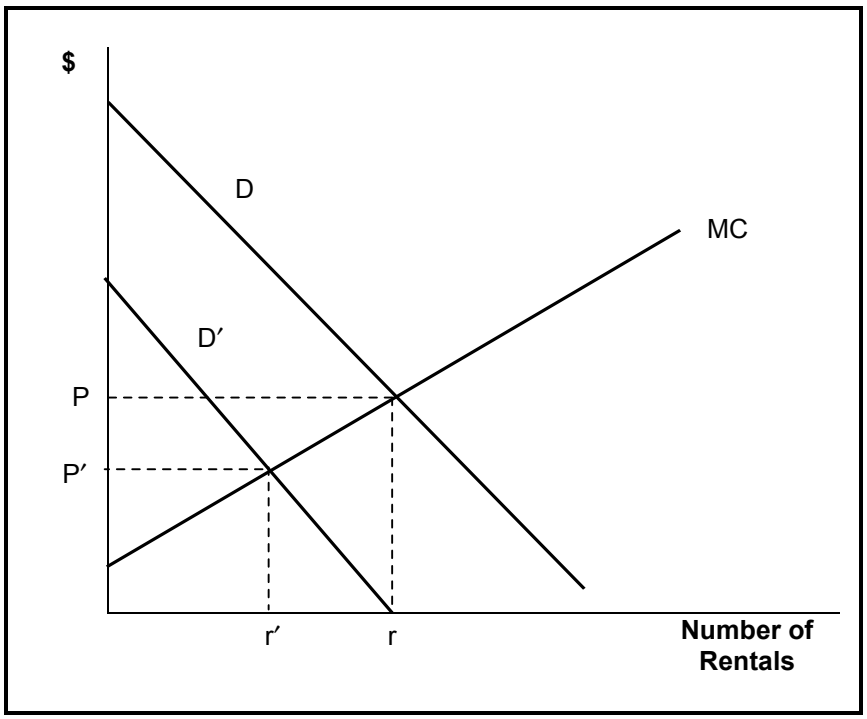


Figure B-4. Producer Surplus and a Change in Demand



If PWC riding decreases as a result of the regulation, then the suppliers of PWC and other tourism-related services will be affected, including rentals and sales of PWC and PWC accessories, lodging, meals, and other tourism-related expenditures. If demand for other types of recreation related rentals increases, then some businesses may experience an offsetting increase in producer surplus.